Single Aisle
TECHNICAL TRAINING MANUAL
T1+T2 (IAE V2500) (Lvl 2&3)
NAVIGATION

This document must be used for training purposes only

Under no circumstances should this document be used as a reference

It will not be updated.

All rights reserved
No part of this manual may be reproduced in any form,
by photostat, microfilm, retrieval system, or any other means,
without the prior written permission of AIRBUS S.A.

AIRBUS Environmental Recommendation
Please consider your environmental responsability before printing this document.

NAVIGATION

GENERAL

Navigation System Control & Indicating (2) 2
Radio Navigation Frequency Selection (3) 4

AIR DATA/INERTIAL REFERENCE SYSTEM (ADIRS)

ADIRS Principle (2) 10
Air Data Probes Presentation (2) 22
ADIRS Switching (2) 28
ADIRS Alignment through MCDU (2) 32

INTEGRATED STBY INSTRUMENT SYSTEM (ISIS)

ISIS D/O (3) 44
ISIS Interfaces (3) 58
ISIS BITE and Test (3) 60

MULTI MODE RECEIVER (MMR) SYSTEM

MMR System Presentation (2) 66
MMR System Description/Operation (3) 80

WEATHER RADAR(WXR)& PREDICTIVE WINDSHEAR(PWS)

WXR/PWS System Presentation (2) 86
WXR/PWS Description/Operation (3) 98
WXR/PWS Operational Precautions (2) 104

RADIO ALTIMETER (RA) SYSTEM

Radio Altimeter System Presentation (2) 106
Radio Altimeter Description/Operation (3) 116

TRAFFIC COLLISION AVOIDANCE SYSTEM (TCAS)

TCAS Presentation (2) 118
TCAS Description/Operation (3) 130

GROUND PROXIMITY WARNING SYSTEM (EGPWS)

EGPWS Presentation (2) 134
EGPWS Description/Operation (3) 140
EGPWS Modes (3) 148

DISTANCE MEASURING EQUIPMENT (DME) SYSTEM

DME System Presentation (2) 168
DME Description/Operation (3) 174

AIR TRAFFIC CONTROL (ATC) SYSTEM

ATC System Presentation (2) 176
ATC Description/Operation (3) 184

AUTOMATIC DIRECTION FINDER (ADF) SYSTEM

ADF System Presentation (2) 188
ADF Description/Operation (3) 194

VOR/MARKERS SYSTEM

VOR/MKR System Presentation (2) 196
VOR/MKR Description/Operation (3) 212
Navigation System Operation, Control & Indicating (3) 214

UGB13131 - U7ST0M0

NAVIGATION SYSTEM CONTROL & INDICATING (2)

ADIRS, EFIS and RADIO NAV

ISIS and STBY COMPASS

ATC/TCAS, WXR RADAR and EGPWS

UGB13131 - U7ST0M0 - UM34IZLEVEL0202

This Page Intentionally Left Blank

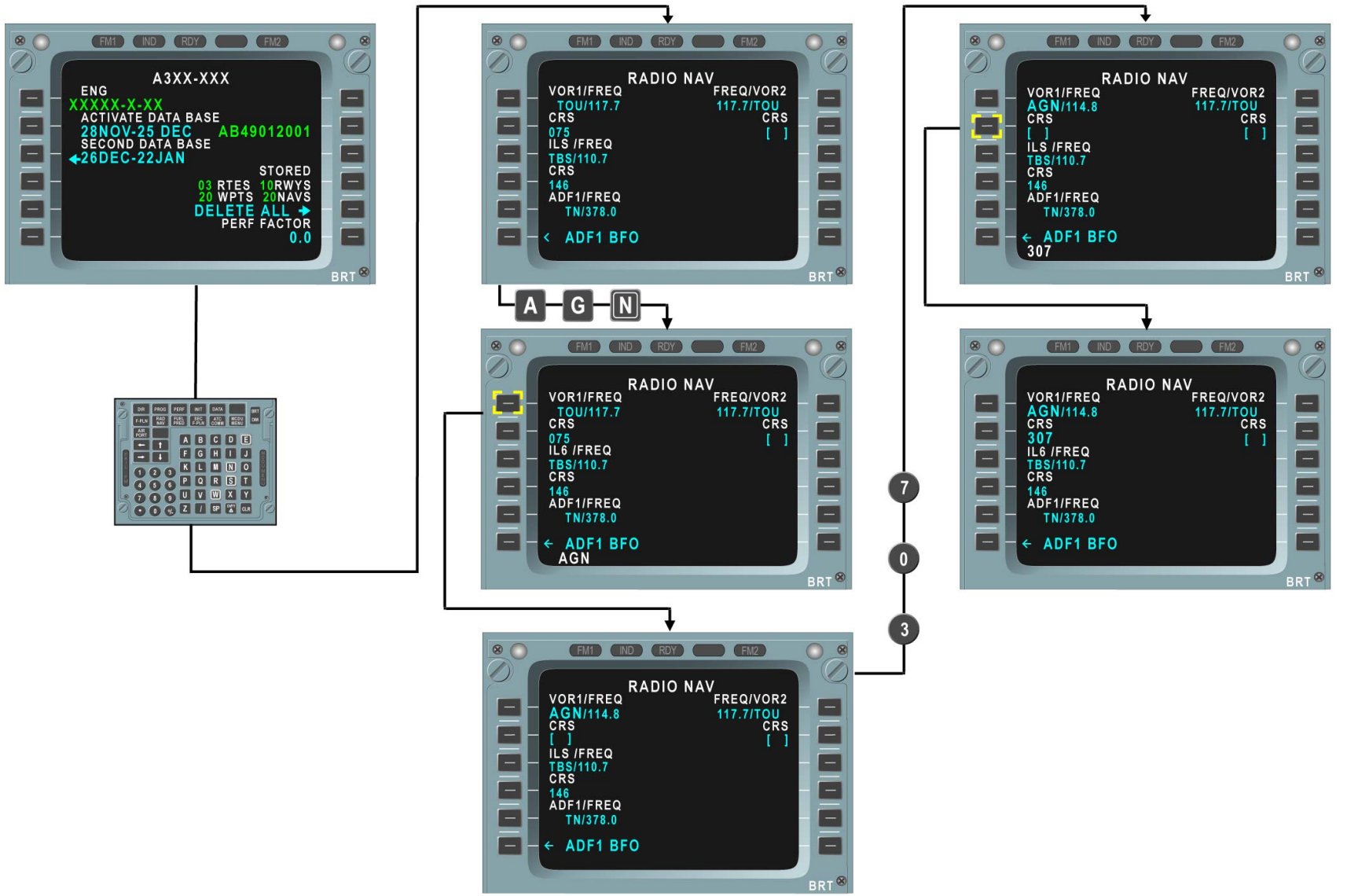
UGB13131 - U7ST0M0 - UM34IZLEVEL0202

RADIO NAVIGATION FREQUENCY SELECTION (3)

VOR 1 SELECTION THROUGH MCDU

To get the RADIO NAV page on the MCDU, the RADio NAVigation key must be selected. When the Flight Management and Guidance Computer (FMGC) auto tunes the NAV receivers, the identifier, frequency and course (VOR only) are shown in small font on the MCDU. The desired VOR 1 beacon indication (AGN shown as example) can be manually inserted using MCDU keys. Then, the selection must be transferred to VOR 1 using the corresponding line select key, identifier will now be shown in big font. The related frequency, found in the database is also displayed and tuned; the course will now blank (between two brackets). The course is also inserted using MCDU line keys (307 shown as example). The selection must be transferred to CRS 1 using the corresponding line select key. When indications on the MCDU are manually entered, they are displayed in big font.

UGB13131 - U7ST0M0 - UM34D1000000001



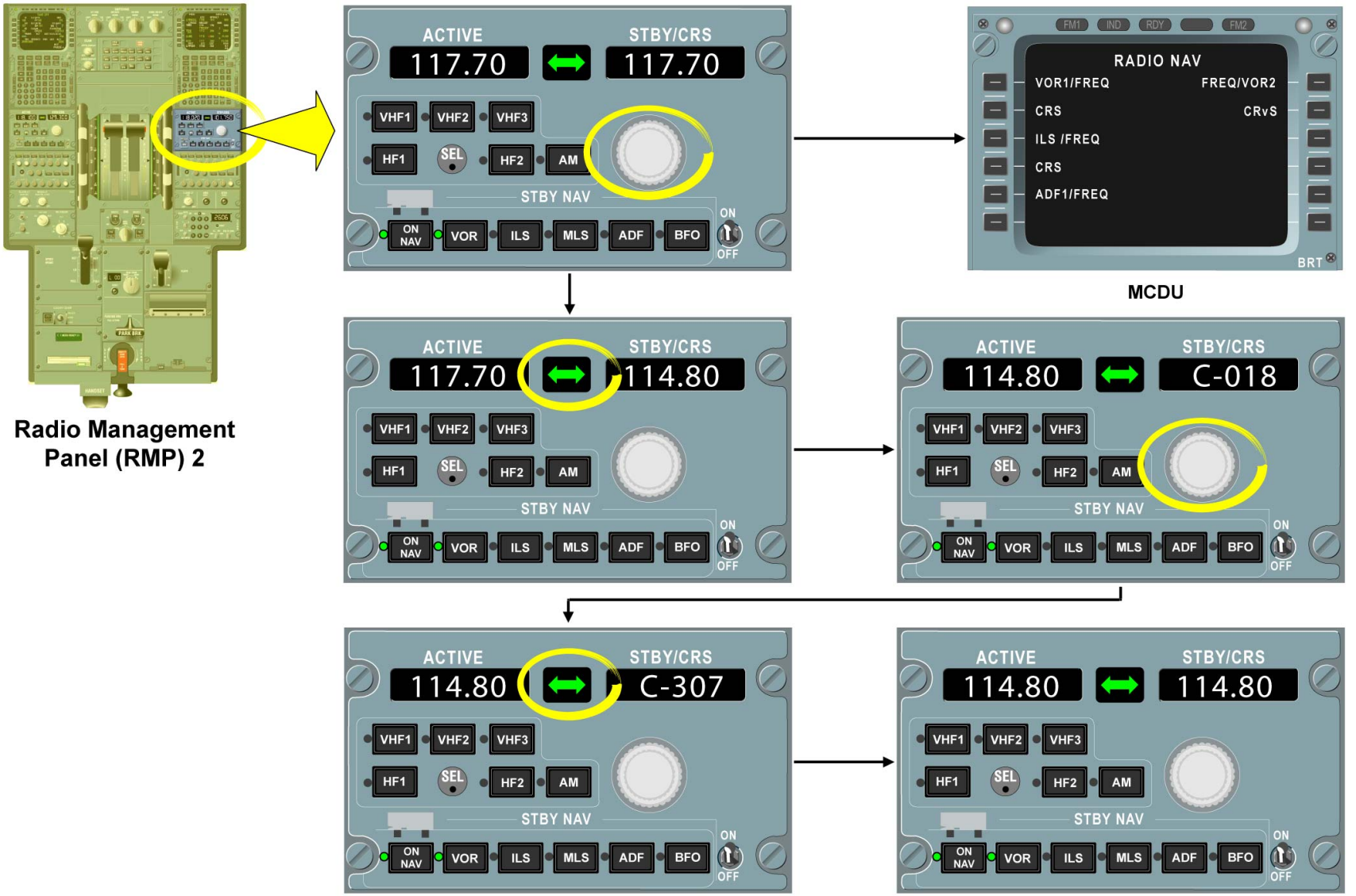
VOR 1 SELECTION THROUGH MCDU

RADIO NAVIGATION FREQUENCY SELECTION (3)

VOR 2 SELECTION THROUGH RMP

This procedure is used as a backup operation only in case of failure of both FMGCs, or failure of the MCDUs. Only the Radio Management Panel (RMP) 2 allows the tuning of F/O side receivers. To activate the RMP navigation keys, the guarded NAV key must be open and selected. The MCDU RADIO NAV page is blocked and all tuning indications disappear. Then the VOR key must be selected and a new VOR frequency can be tuned (114.8 MHz shown as example). Selecting the transfer green key activates the new frequency. The VOR operates on the just entered frequency but uses the previous course. A new VOR course value must be entered (307 shown as example) using the frequency selector knobs on the RMP. Selecting the transfer green key prepares the RMP for a new VOR selection.

UGB13131 - U7ST0M0 - UM34D1000000001



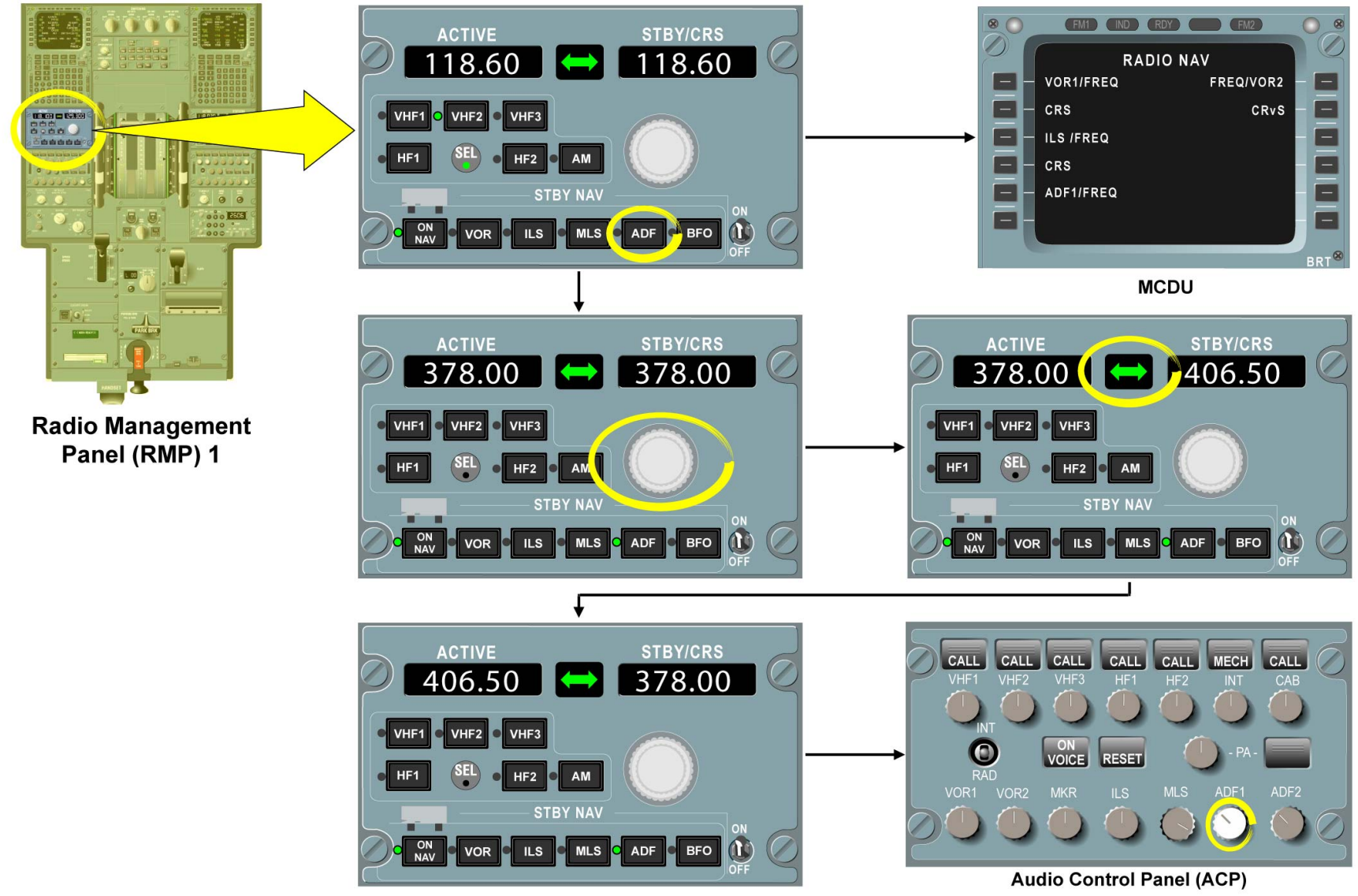
VOR 2 SELECTION THROUGH RMP

RADIO NAVIGATION FREQUENCY SELECTION (3)

ADF 1 SELECTION THROUGH RMP

Only RMP 1 allows the tuning of CAPT side receivers. To activate the RMP navigation keys, the guarded NAV key must be open and selected. Then the Automatic Direction Finder (ADF) key must be selected, and a new ADF frequency can be tuned (406.5 kHz) using the frequency selectors knobs on the RMP 1. Selecting the transfer green key activates the new frequency. It is possible to check the Morse identification of the radio navigation stations using the ADF 1 knob on the Audio Control Panel (ACP). When pressed, the related Morse signal can be heard and the audio level can be adjusted by rotating the knob.

UGB13131 - U7ST0M0 - UM34D1000000001



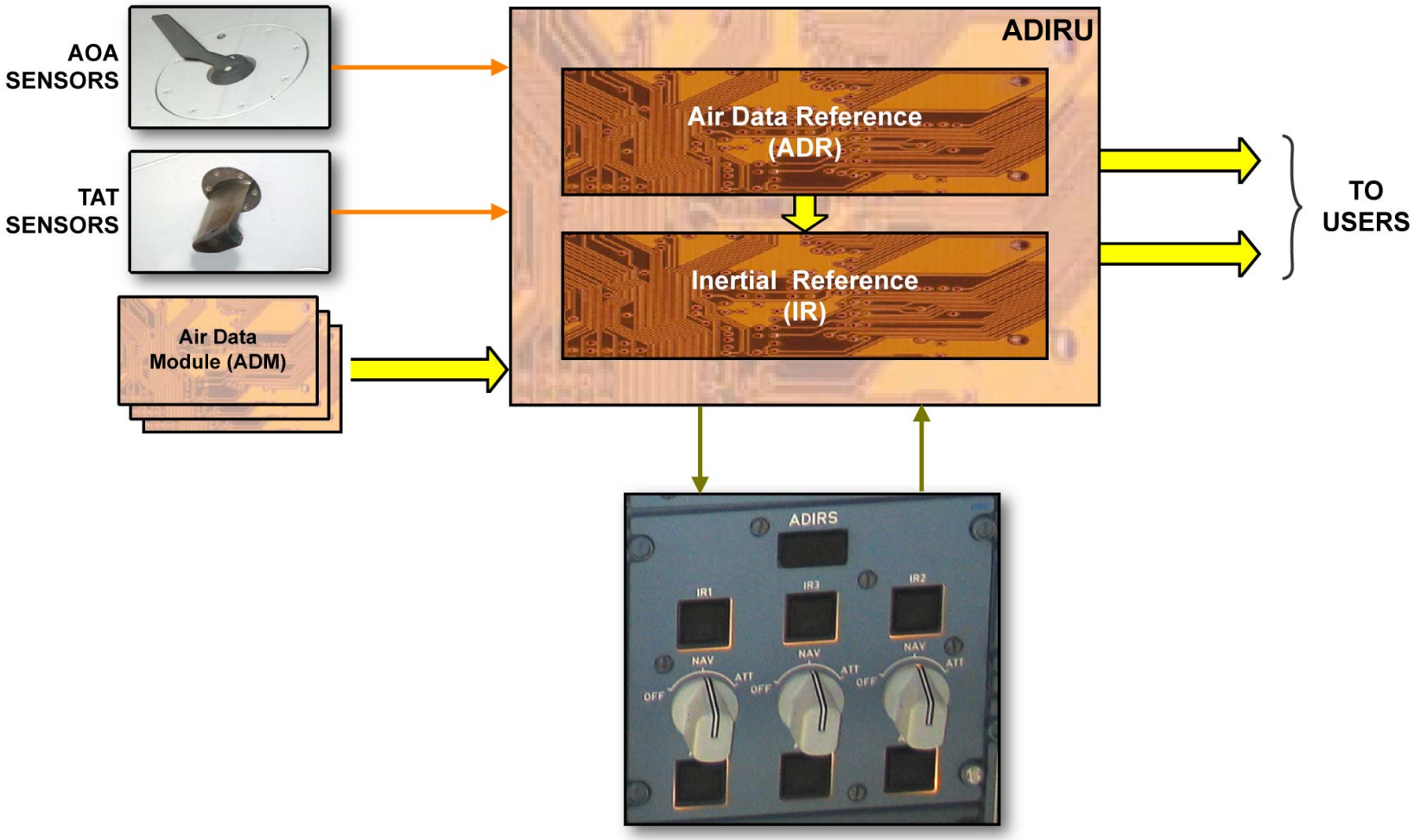
ADF 1 SELECTION THROUGH RMP

ADIRS PRINCIPLE (2)

GENERAL

The Air Data/Inertial Reference Unit (ADIRU) comprises an Air Data Reference (ADR) system and an Inertial Reference (IR) system, both included in a single unit. The ADIRU uses inputs from external sensors: Angle Of Attack (AOA), Total Air Temperature (TAT), and Air Data Module (ADM). The ADIRUs are interfaced with the Air Data/Inertial Reference System (ADIRS) Mode Selector Unit (MSU).

UGB13131 - U7ST0M0 - UM34P1000000001



ADIRS Mode Selector Unit (MSU) (20VU)

ADIRS: Air Data/Inertial Reference System
ADIRU: Air Data/Inertial Reference Unit
AOA: Angle-Of-Attack
TAT: Total Air Temperature

GENERAL

ADIRS PRINCIPLE (2)

ADM FUNCTIONAL DESCRIPTION

The ADM has a microcomputer which processes an ARINC signal according to the discrete inputs and to the digitized pressure.

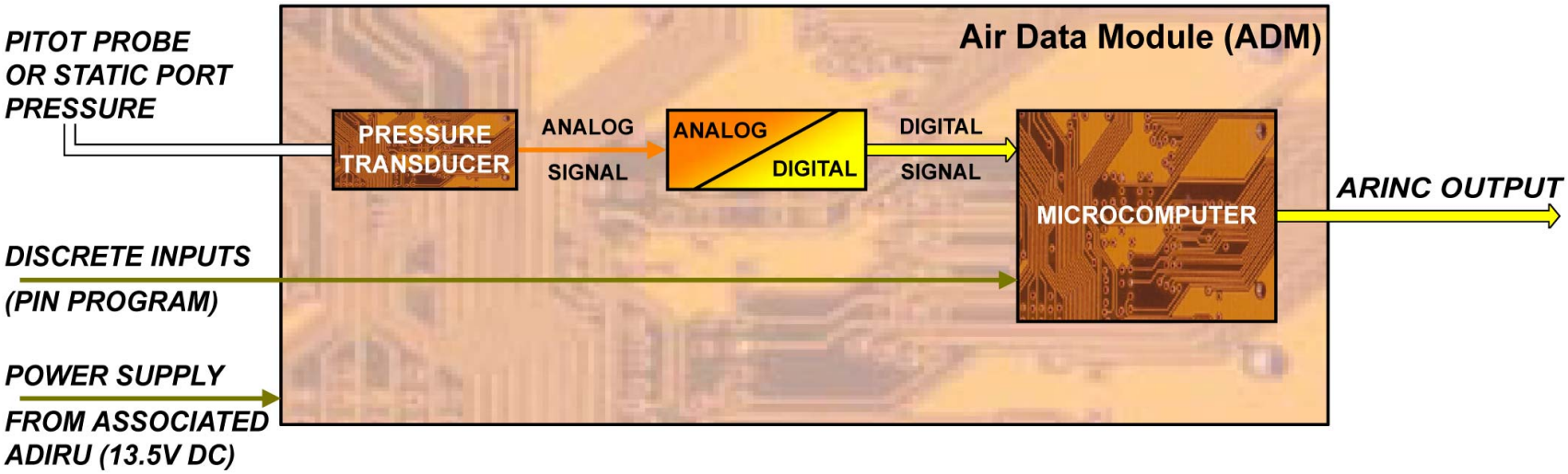
ADM INPUTS

The ADM inputs are one pressure input and several discrete inputs. The ADMs are identical and fully interchangeable. The discrete inputs determine the ADM location and the type of pressure data (Pitot or static) provided to the ADR.

ADM OUTPUTS

The ADM output is an ARINC bus, which gives digital pressure information, type of pressure, ADM identification and BITE status to the ADIRU.

UGB13131 - U7ST0M0 - UM34P1000000001



ADIRU: Air Data/Inertial Reference Unit

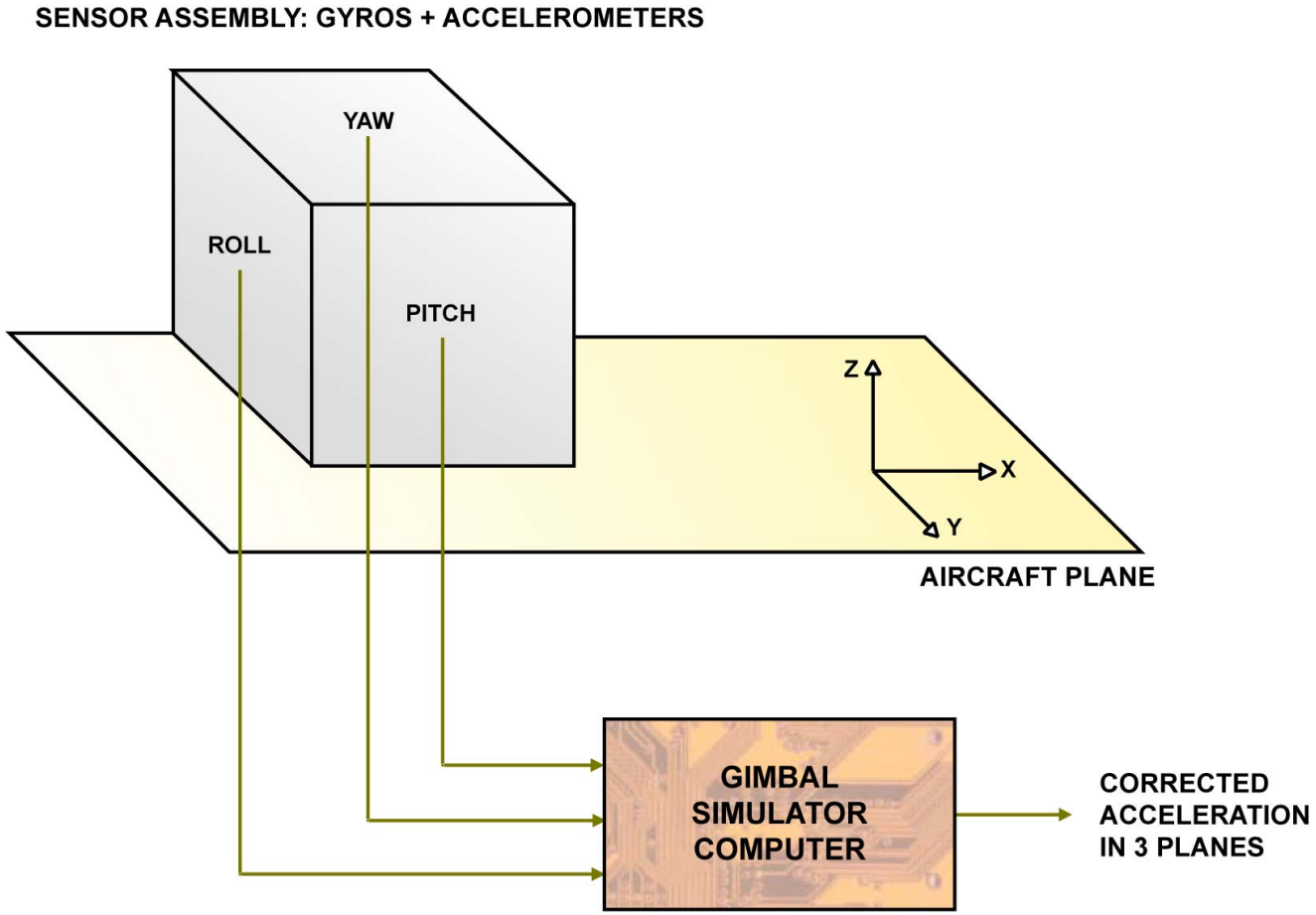
ADM FUNCTIONAL DESCRIPTION ... ADM OUTPUTS

ADIRS PRINCIPLE (2)

IR STRAPDOWN

In a strapdown Inertial Reference System (IRS) the gyros and the accelerometers are solidly attached to the aircraft structure. The strapdown laser gyro supplies directly accelerations and angular speeds.

UGB13131 - U7ST0M0 - UM34P1000000001



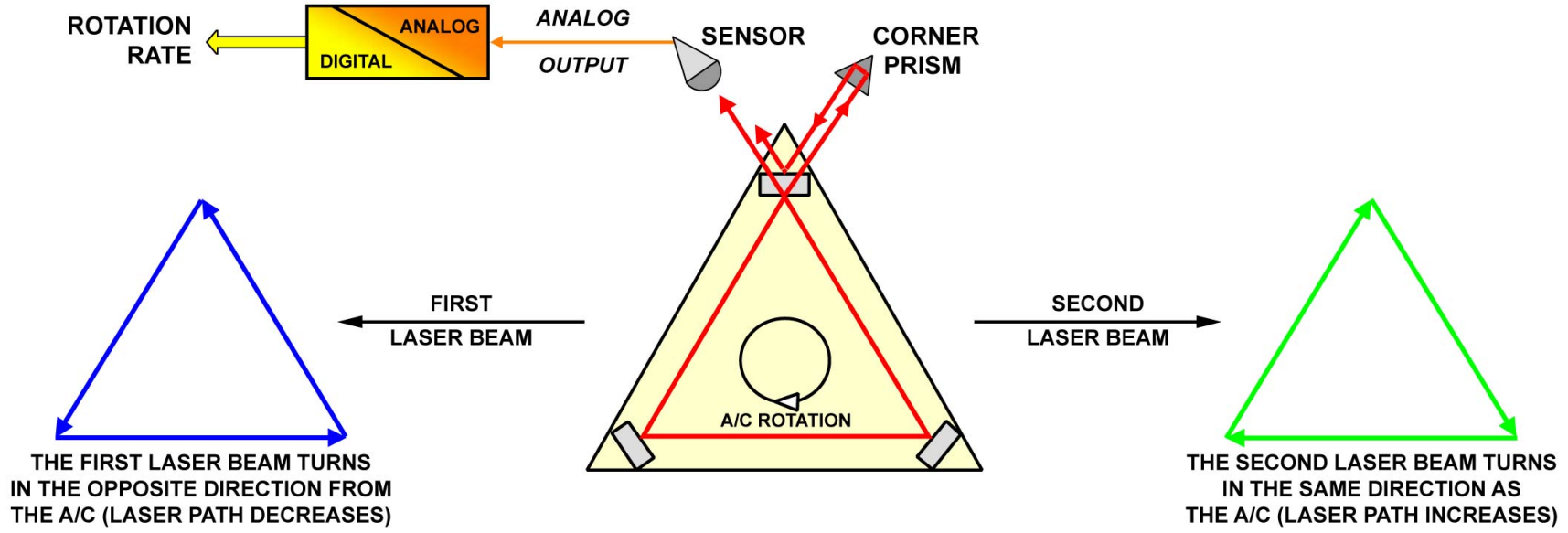
IR STRAPDOWN

ADIRS PRINCIPLE (2)

RING LASER GYRO

The three ring Light Amplification Stimulated Emission of Radiation (LASER) gyros, one for each rotation axis, give inertial rotation data and are composed of two opposite LASER beams in a ring. At rest, the two beams get to the sensor with the same frequency. An aircraft rotation creates a difference of frequencies between the two beams. The frequency difference is measured by optical means providing an analog output, which is sent to an analog/digital converter. After computation this output will provide rotation information.

UGB13131 - U7ST0M0 - UM34P1000000001



ADIRU: Air Data/Inertial Reference Unit

RING LASER GYRO

ADIRS PRINCIPLE (2)

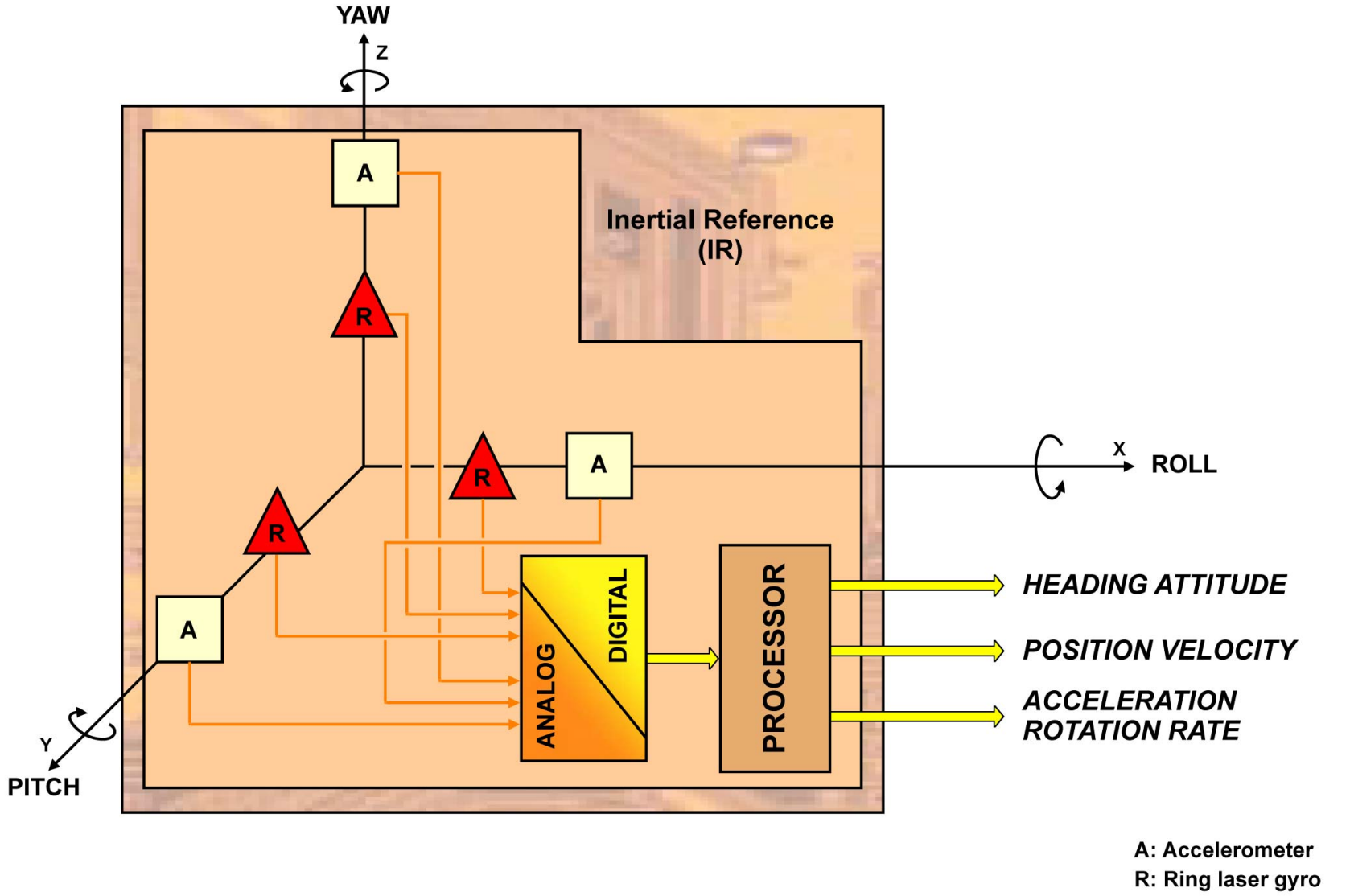
ACCELEROMETER

Three accelerometers, one for each axis, provide linear accelerations. The acceleration signal is sent to an analog/digital converter. The digitized signal is then sent to a processor, which uses this signal to compute the velocity and the position.

IR COMPUTATION

Each ADIRU computes the LASER gyro and the accelerometer outputs to provide IR data to users.

UGB13131 - U7ST0M0 - UM34P1000000001



ACCELEROMETER & IR COMPUTATION

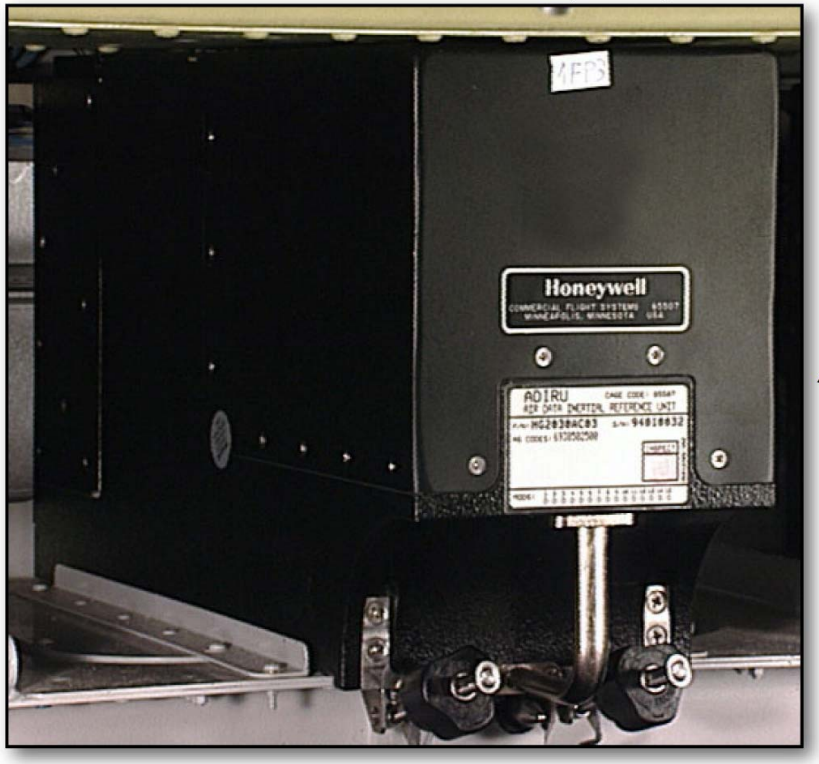
ADIRS PRINCIPLE (2)

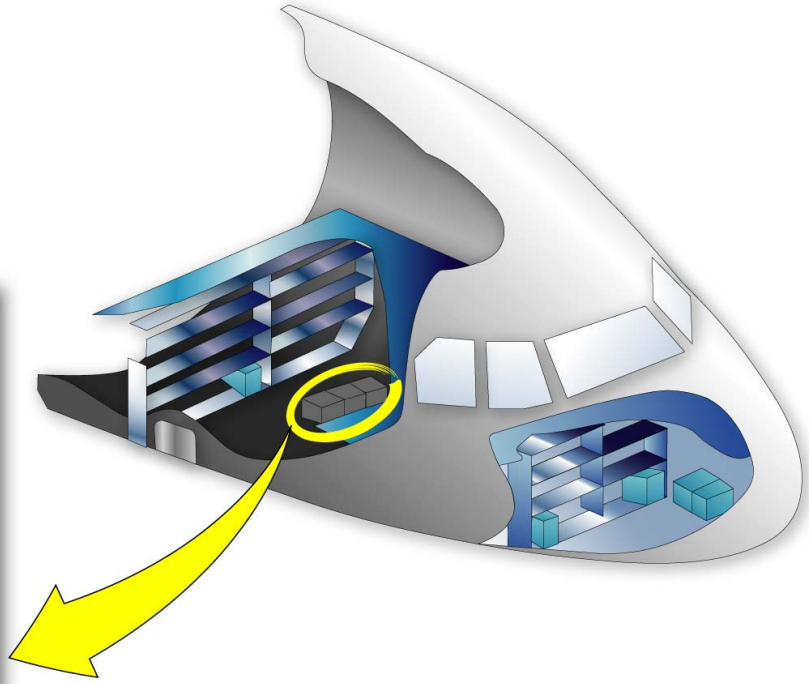
COMPONENT LOCATION

The 3 ADIRUs are in the aft avionics compartment forward of the 80VU.

UGB13131 - U7ST0M0 - UM34P1000000001

Air Data Inertial Reference Unit (ADIRU)





COMPONENT LOCATION

AIR DATA PROBES PRESENTATION (2)

STANDARD CONFIGURATION

PITOT PROBES

Three Pitot probes provide total pressure to three Air Data Modules (ADMs), which convert this pressure into digital format: ARINC 429. ARINC words are then sent to the corresponding Air Data/Inertial Reference Unit (ADIRU).

STATIC PORTS

Six static ports provide static pressure to five ADMs, which convert this pressure into digital format: ARINC 429. The two standby static ports provide an average pressure directly to the standby instruments, and to ADR 3 through a single ADM.

AOA SENSORS

Each ADIRU receives Angle-Of-Attack (AOA) information from its corresponding AOA sensor. The AOA sensors are also called Alpha probes.

TAT SENSORS

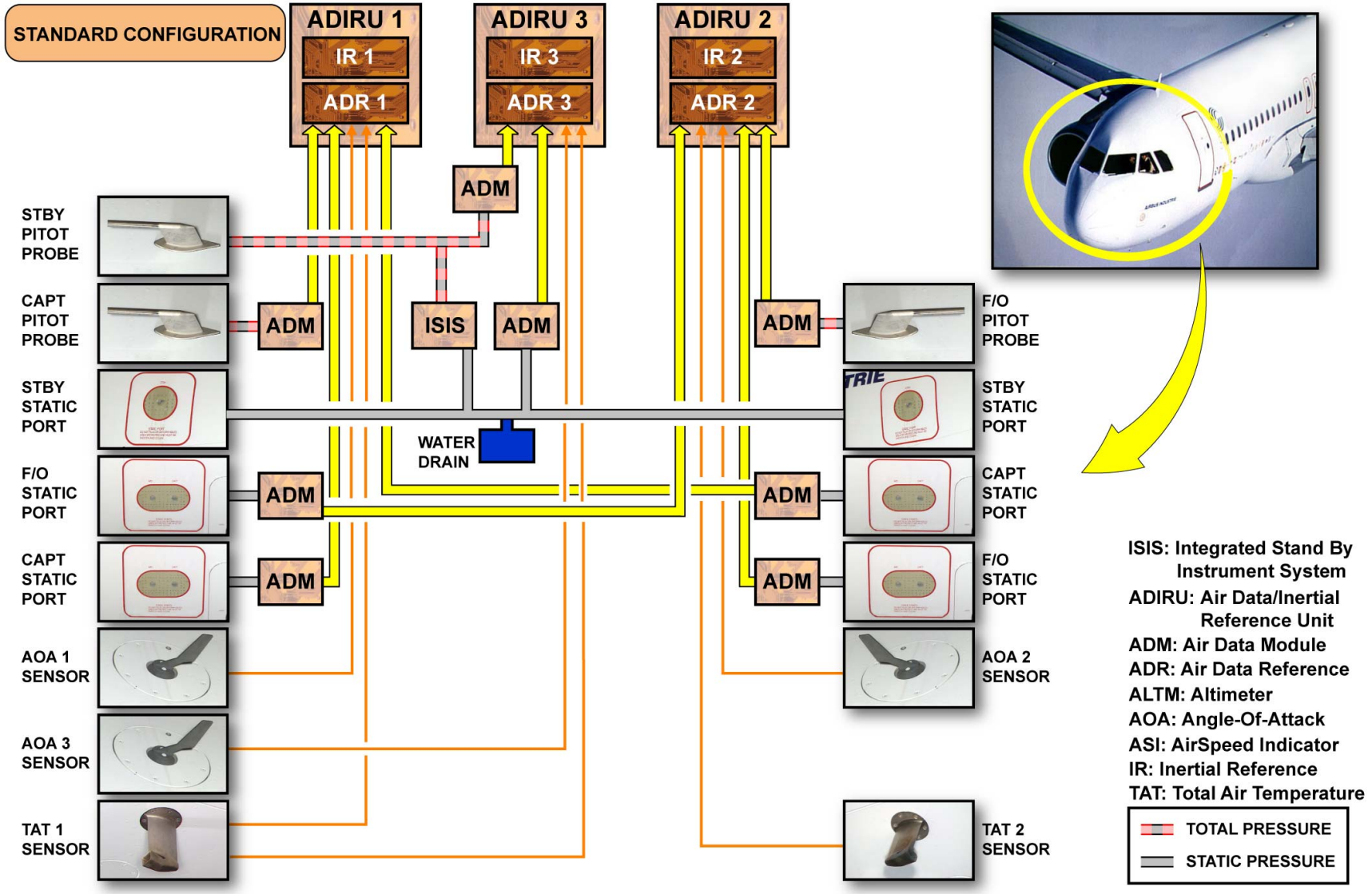
The three ADIRUs receive Total Air Temperature (TAT) information from two TAT sensors.

NOTE: The two TAT sensors are composed of two sensing elements. ADIRU 3 receives the TAT from TAT sensor 1 one only.

WATER DRAIN

The probes are installed in such a way that their pressure lines do not require a water drain, except for that of the standby static ports.

UGB13131 - U7ST0M0 - UM34P2000000001



STANDARD CONFIGURATION - PITOT PROBES ... WATER DRAIN

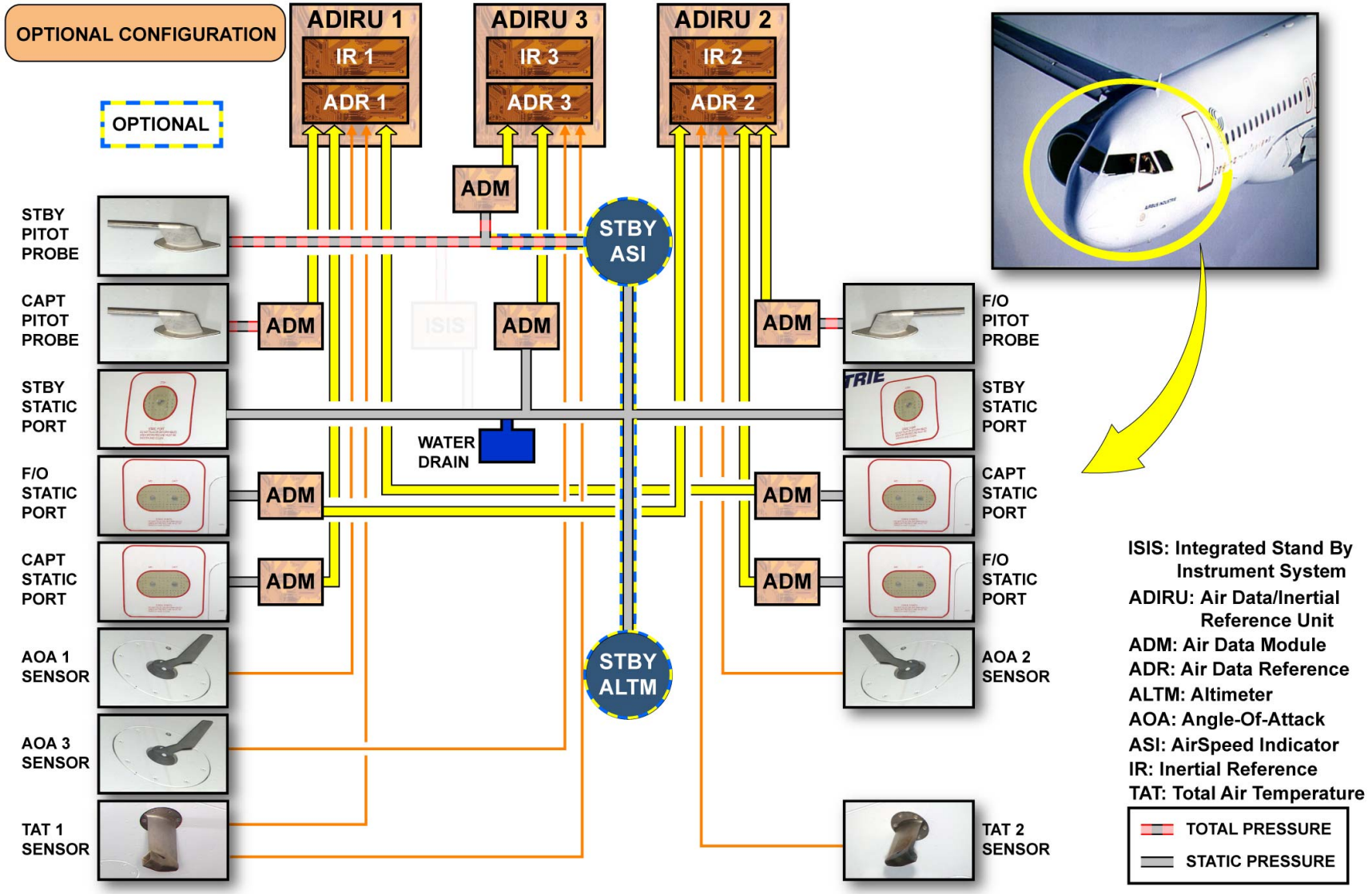
AIR DATA PROBES PRESENTATION (2)

OPTIONAL CONFIGURATION

CLASSIC STANDBY INSTRUMENTS

The classic standby instruments (Altimeter, Air speed indicator and horizon) can be installed instead of ISIS. The standby Pitot probe supplies the standby AirSpeed Indicator (ASI) directly and the Air Data Reference (ADR) 3 through its related ADM.

UGB13131 - U7ST0M0 - UM34P2000000001



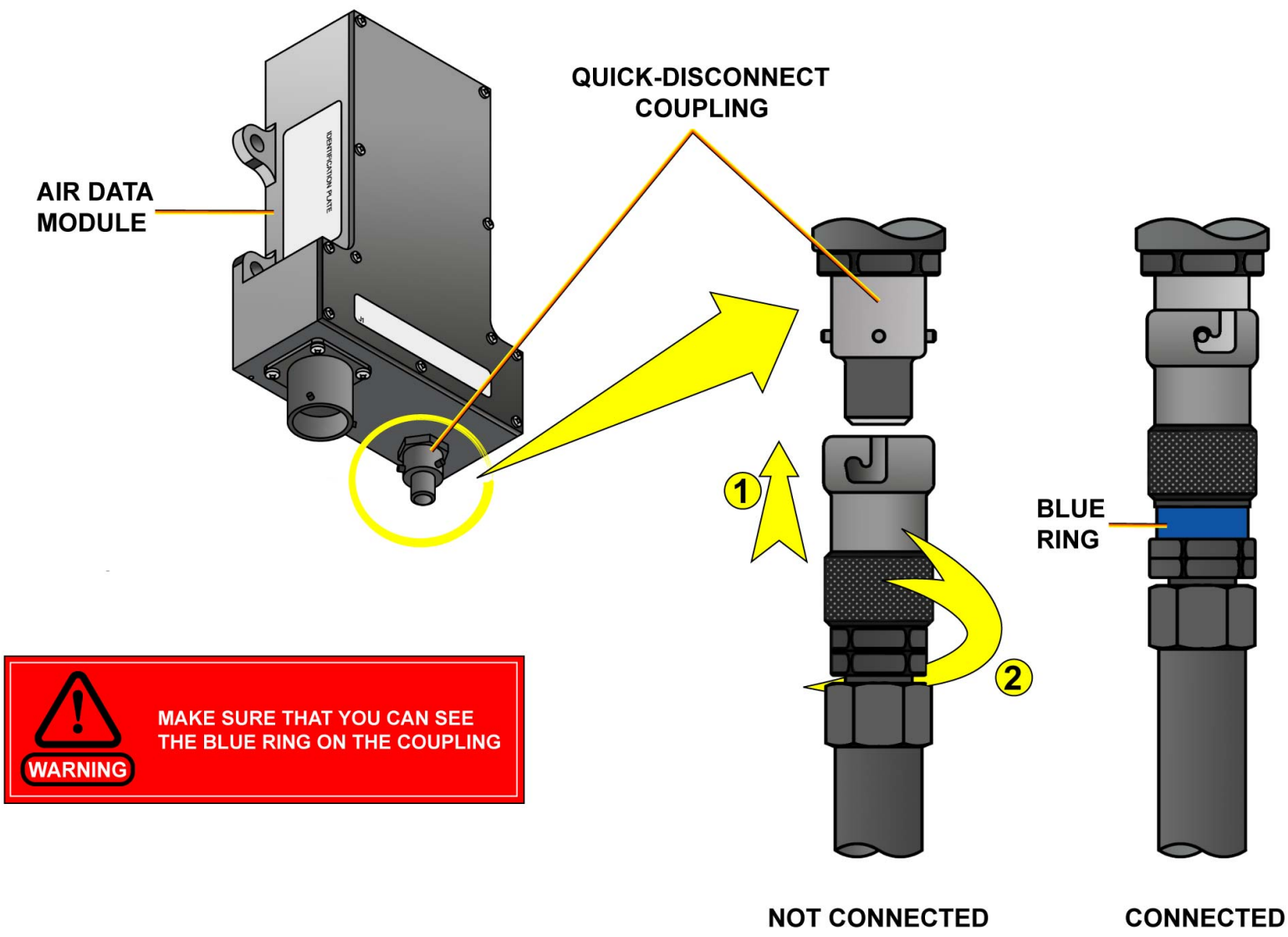
OPTIONAL CONFIGURATION - CLASSIC STANDBY INSTRUMENTS

AIR DATA PROBES PRESENTATION (2)

ADM PNEUMATIC CONNECTION

To connect the ADM quick-disconnect coupling, make sure that you can see the blue ring on the coupling and pull it to make sure that it is correctly attached.

UGB13131 - U7ST0M0 - UM34P2000000001



ADM PNEUMATIC CONNECTION

ADIRS SWITCHING (2)

GENERAL

The Air Data/Inertial Reference System (ADIRS) is composed of three Air Data Inertial Reference Units (ADIRUs).

PRINCIPLE

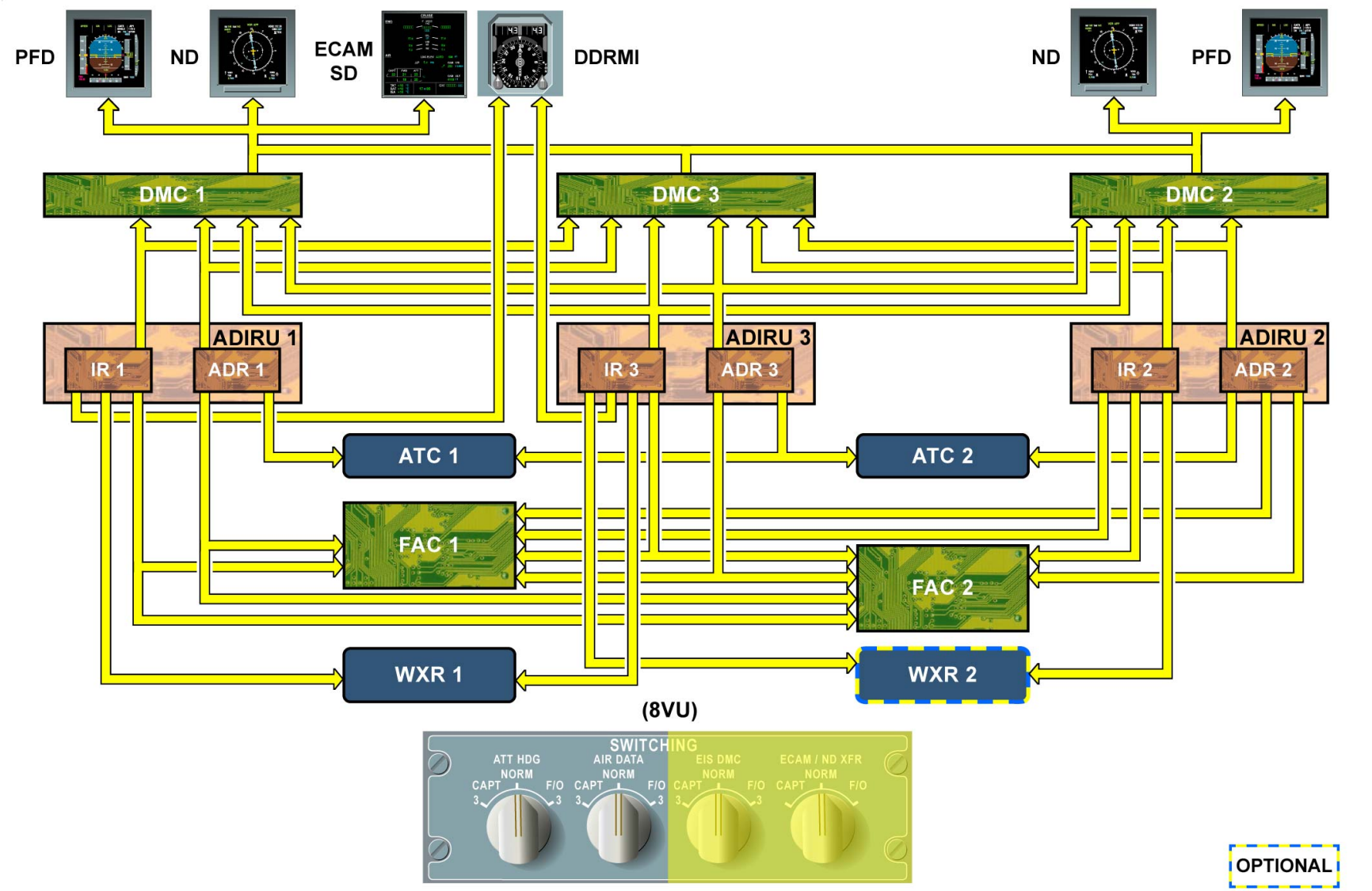
Various instruments and systems receive data from the ADIRS for inertial and air data display:
- the PFDs,
- the NDs,
- the ECAM SD,
- the Digital Distance and Radio Magnetic Indicator (DDRMI).

The ADIRUs transmit air data, attitude and navigation parameters to various user systems. As an example, the ADIRS provides:
- barometric altitude data to the Air Traffic Control (ATC) system for mode C and S,
- data to the Flight Augmentation Computers (FACs) for computation of various characteristic speeds,
- data to the Weather Radar (WXR) system for antenna attitude stabilization.

Basically, ADIRU 1 is associated with systems 1 and the DDRMI, ADIRU 2 with systems 2, and ADIRU 3 is in standby. ADIRU 3 can substitute either system, for this purpose it has interfaces with the three Display Management Computers (DMCs). If an Air Data Reference (ADR) or an Inertial Reference (IR) fails, the AIR DATA or ATTitude HeaDinG selectors enable the crew to use ADR 3 or IR 3. The manual switching is mainly performed to recover displays. The computers select their inputs according to the switching for consistency of computation and display.

NOTE: The ADIRU data sent to the ECAM SD are Static Air Temperature (SAT), Total Air Temperature (TAT) and International Standard Atmosphere (ISA).

UGB13131 - U7ST0M0 - UM34D2000000001



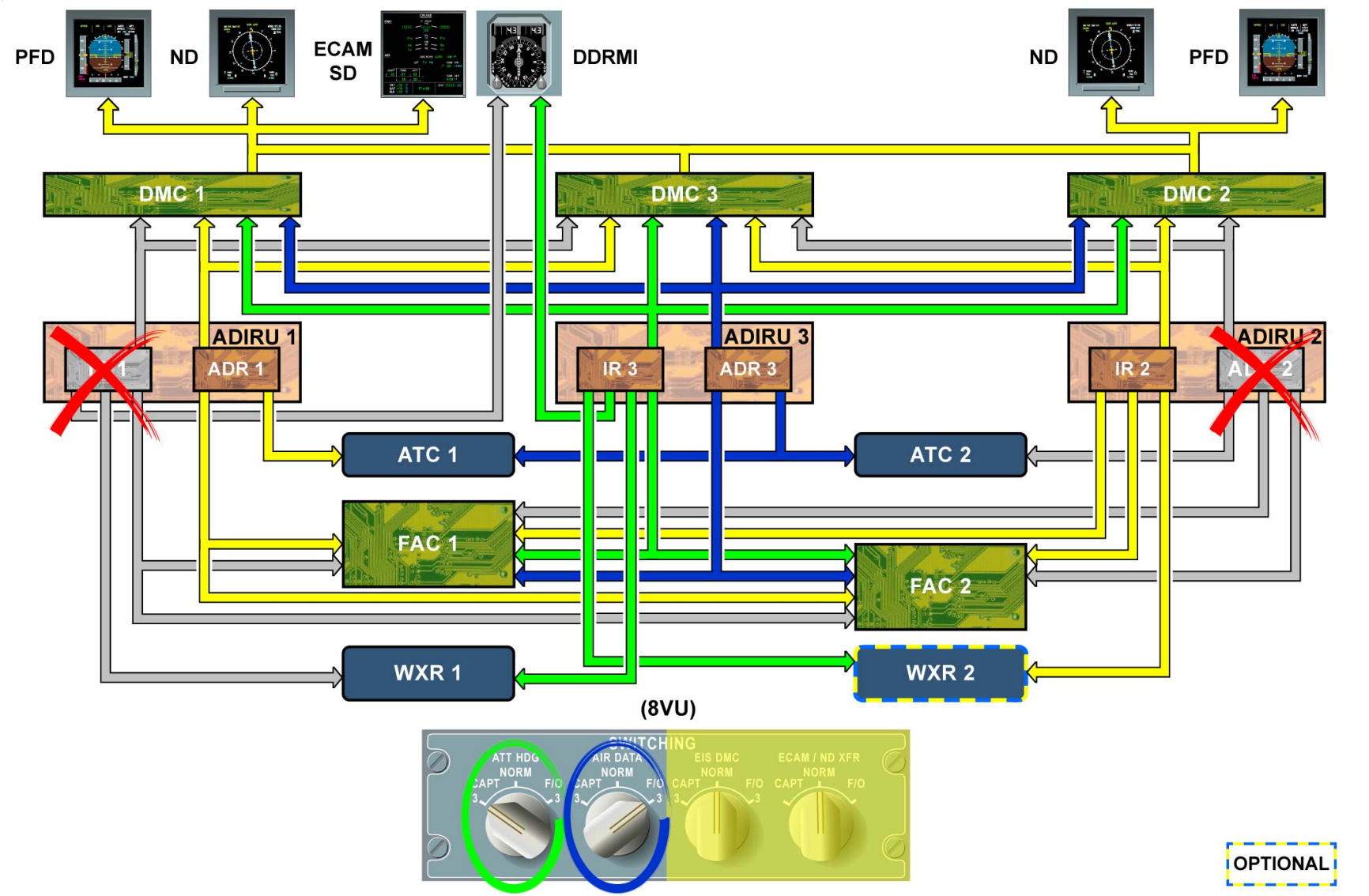
GENERAL & PRINCIPLE

ADIRS SWITCHING (2)

SWITCHING EXAMPLE

Here is an example of ADIRS switching with IR 1 and ADR 2 failed in order to see the effects on the schematic.

UGB13131 - U7ST0M0 - UM34D2000000001



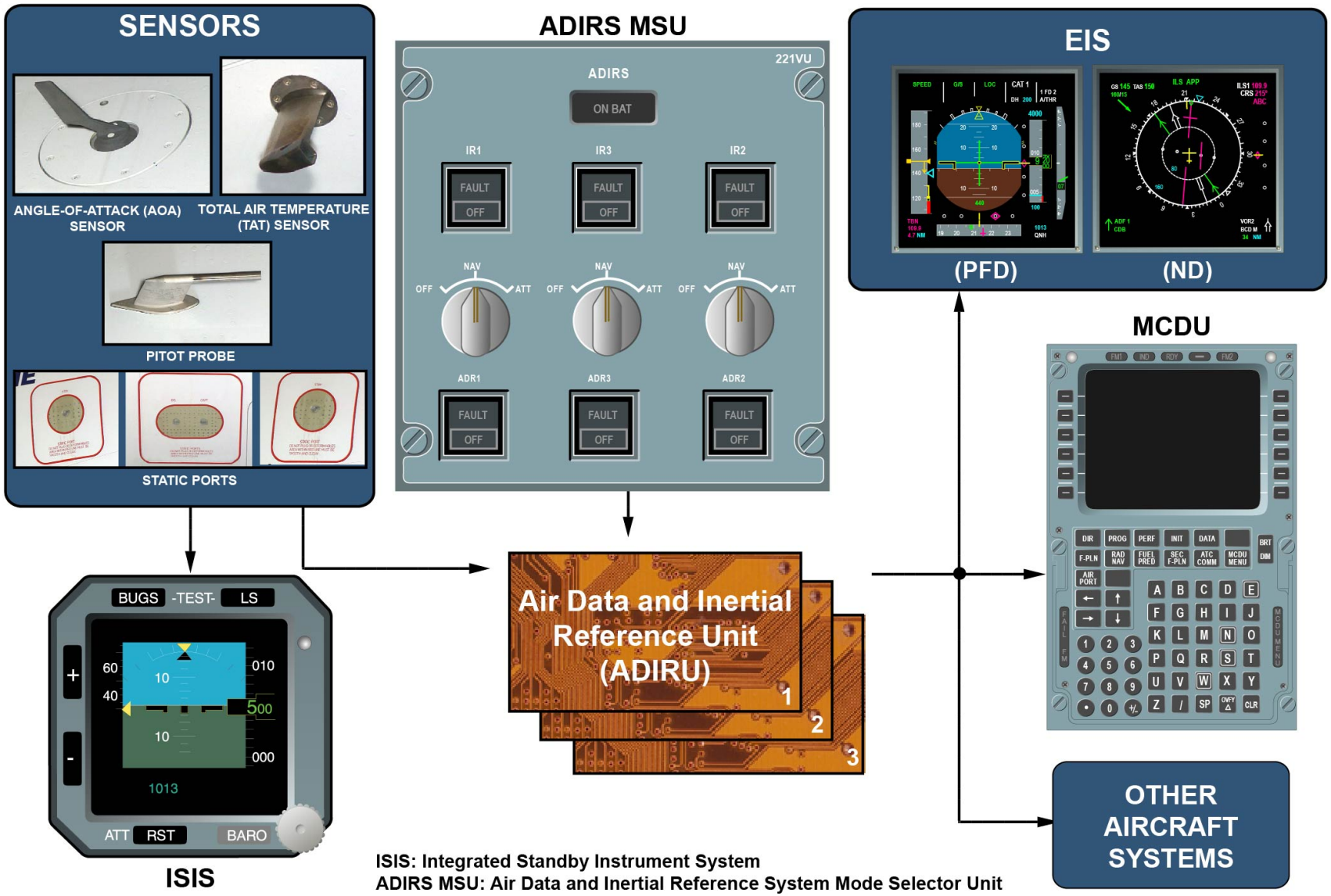
SWITCHING EXAMPLE

ADIRS ALIGNMENT THROUGH MCDU (2)

GENERAL

The Air Data and Inertial Reference System (ADIRS) has three identical Air Data and Inertial Reference Units (ADIRUs), one ADIRS Mode Selector Unit (ADIRS MSU) and a number of sensors. The ADIRUs receive information from the sensors to compute air and internal laser gyros and the accelerometers to compute inertial data. This data is displayed to the crew and sent to the MCDU and other A/C systems. The sensors also send data to the Integrated Standby Instrument System (ISIS) for standby display.

UGB13131 - U7ST0M0 - UM34D3000000001



ISIS: Integrated Standby Instrument System
ADIRS MSU: Air Data and Inertial Reference System Mode Selector Unit

GENERAL

ADIRS ALIGNMENT THROUGH MCDU (2)

ADIRS - ALIGNMENT

BATTERIES TEST

NOTE: Note: There is no specific ADIRS battery.

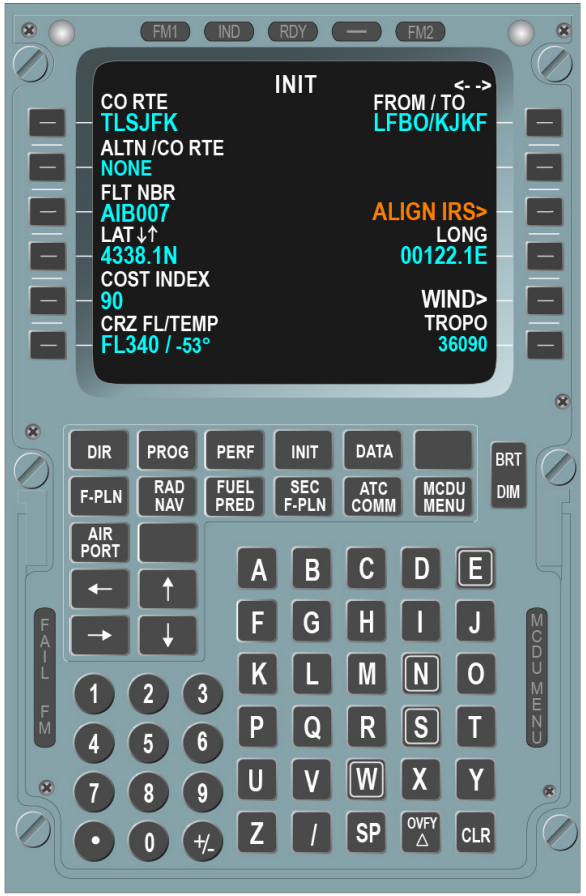
ALIGNMENT OF THE IRS

The Flight Management Guidance and Envelope System (FMGES) uses the reference point coordinates of the departure airport to align the Inertial Reference System (IRS). It automatically finds these coordinates in the database after the operator enters a company route or an origin-destination city pair and pushes the ALIGN IRS key on the MCDU. The operator can manually adjust these coordinates to the gate position. The time necessary for a full alignment is 10 minutes. It is necessary to do a specific alignment procedure between 73°and 82° north or south (refer to FCOM documentation). The alignment procedure is not possible at more than 82° north or south.

UGB13131 - U7ST0M0 - UM34D3000000001

ADIRS MSU

MCDU



Each time a selector is set to NAV, the ON BAT ligth comes on for a few seconds to do a test of the switching to the aircraft batteries.

ADIRS - ALIGNMENT - BATTERIES TEST & ALIGNMENT OF THE IRS

ADIRS ALIGNMENT THROUGH MCDU (2)

ADIRS - ALIGNMENT (continued)

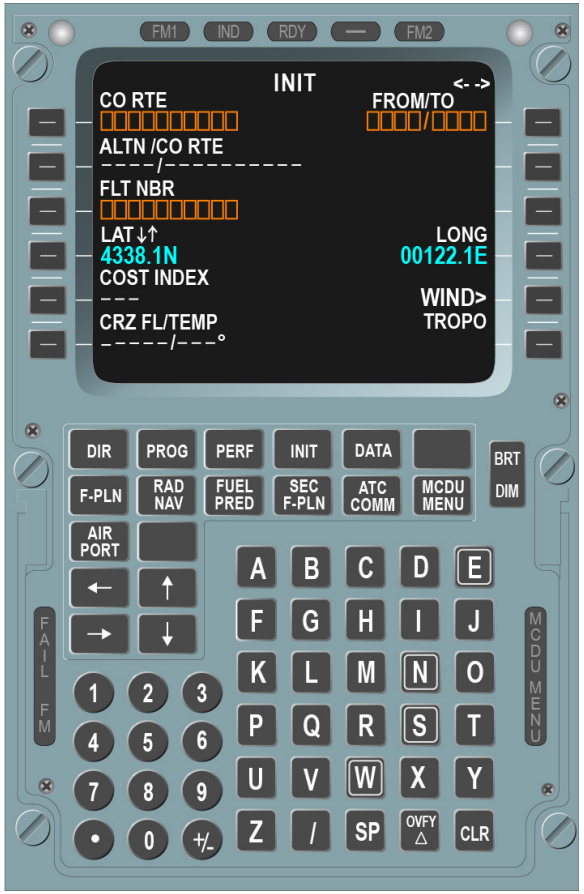
AUTOMATIC ALIGNMENT BY GPS (OPTION)

With the latest ADIRUs, an optional automatic alignment by GPS position is possible. With this initialization by GPS, no operator action is necessary. Less than 1 minute after the ADIRS is set to NAV, the INIT page displays the GPS position, but does not display the ALIGN IRS prompt message. The time necessary for a full alignment will be between 5 and 10 minutes in relation to the local latitude and a maximum of 17 minutes between 73° and 82° north or south. If the operator enters a company route or an origin-destination city pair, the INIT page displays the departure airport reference-point coordinates, and the IRS ALIGN prompt message comes into view. If the prompt key is not pushed, the ADIRS will be aligned on the GPS position. If the prompt key is pushed, the ADIRS will be aligned on the reference point coordinates of the departure airport. The operator can also use the MCDU latitude and longitude keys of the INIT page to change the given aircraft position. This will cause the ALIGN IRS prompt key to come into view. This prompt key must then be pushed.

UGB13131 - U7ST0M0 - UM34D3000000001

ADIRS MSU

MCDU



With the initialization by GPS, no operator action is necessary on the MCDU.

ADIRS - ALIGNMENT - AUTOMATIC ALIGNMENT BY GPS (OPTION)

ADIRS ALIGNMENT THROUGH MCDU (2)

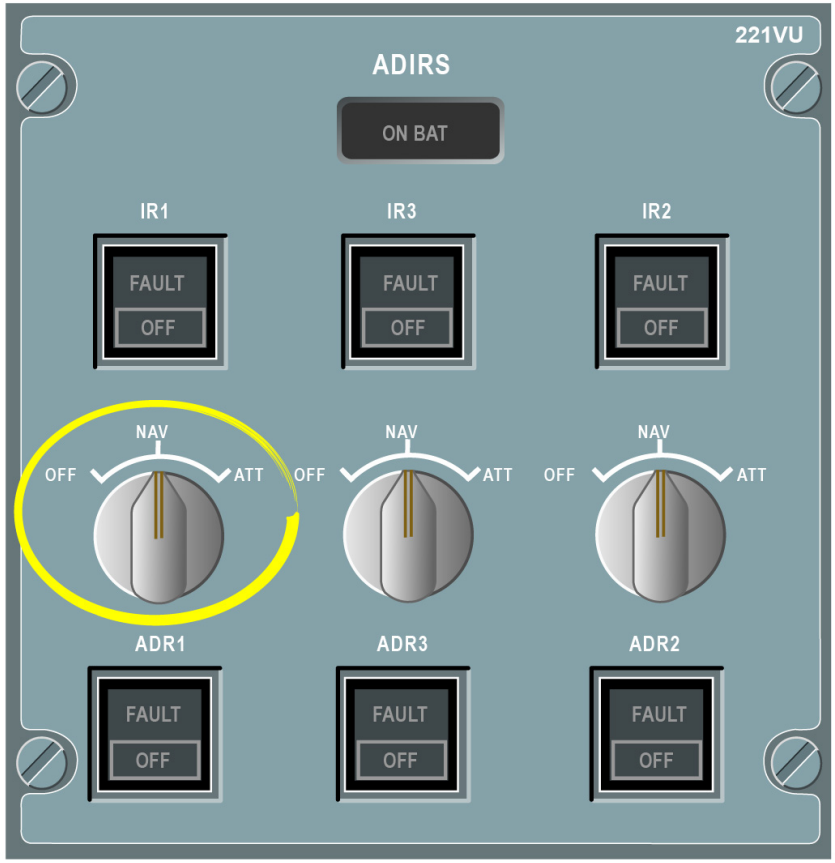
ADIRS - ALIGNMENT (continued)

FAST REALIGNMENT

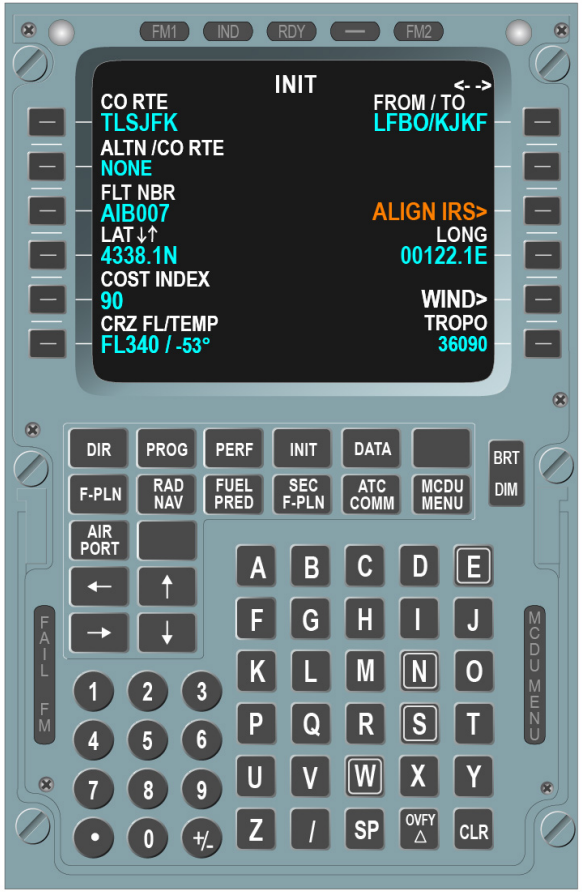
During transit or en-route stops with short ground times, the flight crew can do a fast realignment with the selector, which must be turned from NAV to OFF and then back to NAV in less than 5 seconds. The Inertial Reference (IR) starts a 30-second realignment with existing attitude, heading angles and velocities set to zero.

NOTE: Note: The ALIGN IRS prompt will come into view and must be pushed to do the alignment. With the optional automatic alignment by GPS, the procedure is the same but no pilot entry is necessary (no action necessary on the ALIGN IRS prompt).

ADIRS MSU



MCDU



30-second fast realignment:
Set the selector from NAV to OFF
and back to NAV in less than 5 seconds.

ADIRS - ALIGNMENT - FAST REALIGNMENT

ADIRS ALIGNMENT THROUGH MCDU (2)

INTERRUPTION DURING ALIGNMENT

EXCESSIVE MOTION

If taxiing or towing causes a step input that is more than a specified threshold, alignment or fast realignment is stopped and then the ADIRUs start a 10-minute alignment again. Step input threshold: 0.5 ft/s, 30 seconds after the detection of movement, and if no other movement occurs, a 10-minute alignment starts.

NOTE: Note: It is not necessary to re-initialize the position if already entered.

TEST OF STORED POSITION

When the initial position is entered, the ADIRUs do a check to find if this position is within a threshold of the computed position, which was stored at the last ADIRU shutdown. If not, an MCDU message "REALIGN IRS" is displayed to enter the present position. Test threshold: 1° for latitude and longitude during alignment, 0.5° during fast realignment.

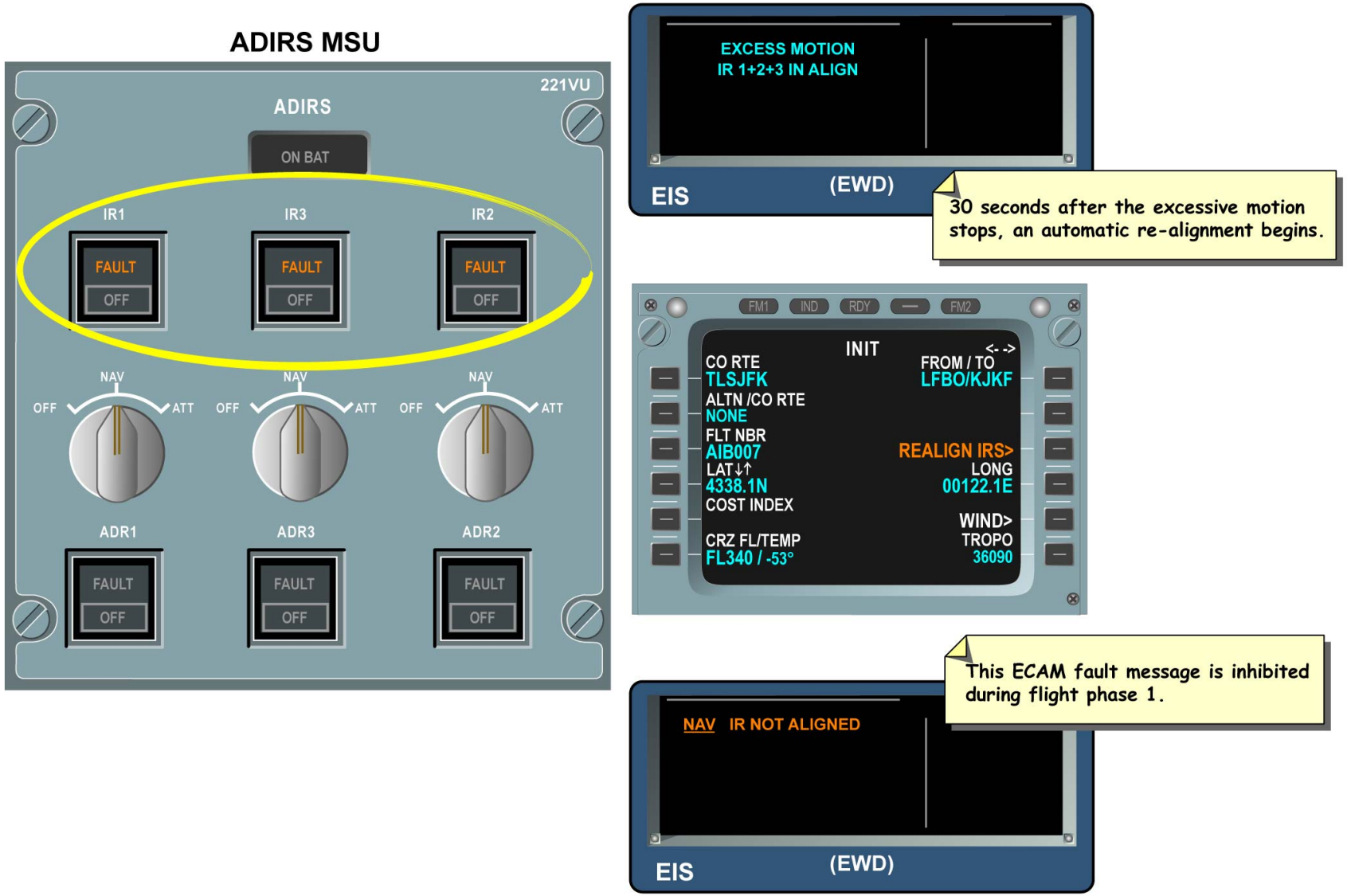
NOTE: Note: If the result of the test for the new position is not correct, the system waits for another position entry. If the same position (out of the threshold) is entered two times, the ADIRUs accept it as a deliberate choice.

TEST OF COMPUTED LATITUDE

At the end of the alignment, the ADIRUs do a check to find if the entered latitude is within a threshold of the self-computed latitude. If not, an MCDU message "REALIGN IRS" is displayed to enter the present position. When a new position is entered, the IRS alignment is necessary. If the test result is correct for this position, the alignment is completed.

NOTE: Note: If the test is done two times, one after the other, and the test results are not correct, the IRS detects a fault situation (indications on MSU and EWD). If this occurs, set the ADIRUs to OFF, wait for 20 seconds and try to do a full alignment again.

UGB13131 - U7ST0M0 - UM34D3000000001



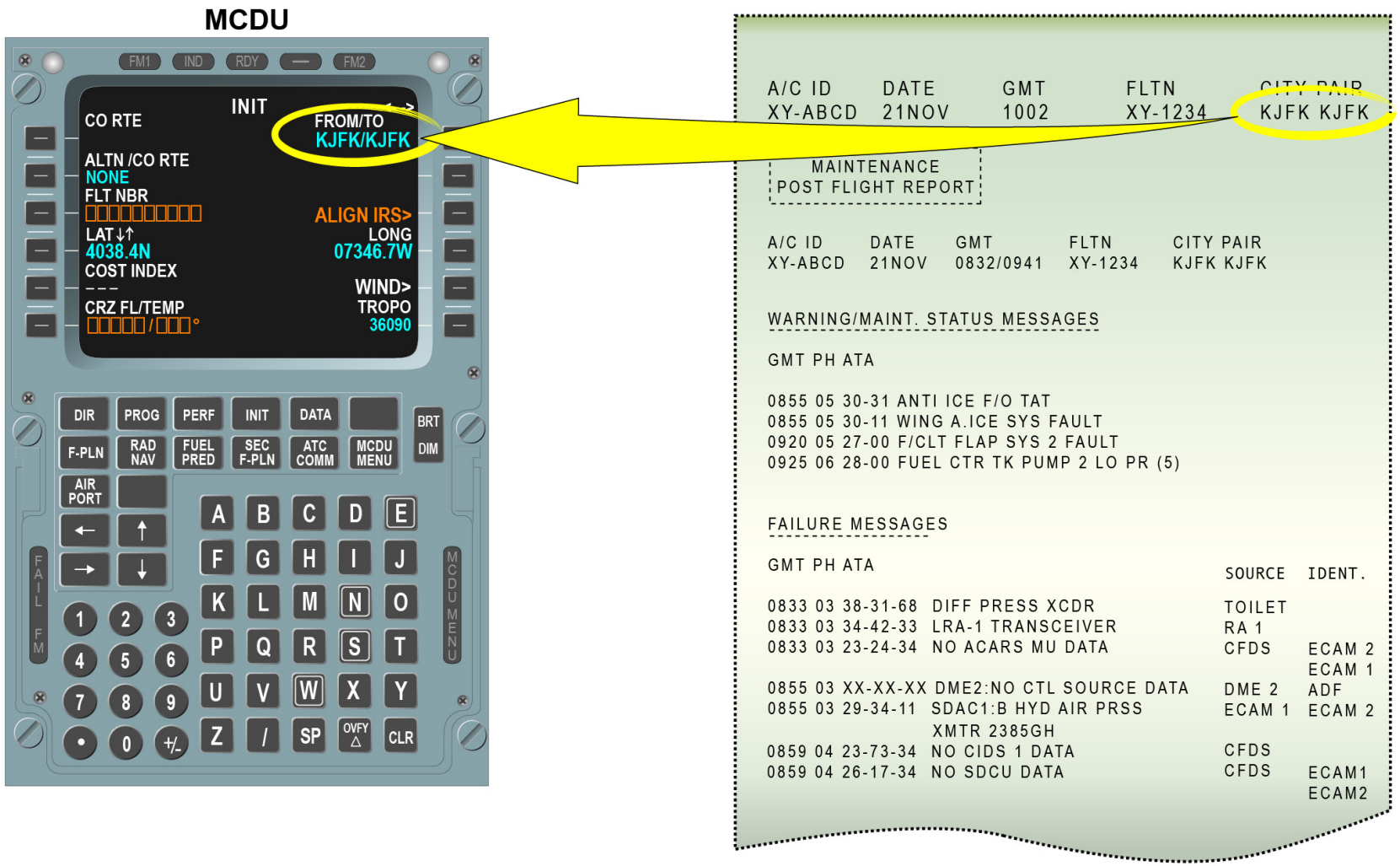
INTERRUPTION DURING ALIGNMENT - EXCESSIVE MOTION ... TEST OF COMPUTED LATITUDE

ADIRS ALIGNMENT THROUGH MCDU (2)

MAINTENANCE TIPS

In some conditions, if you do not know the airport point coordinates, a long time can be necessary for the alignment of the ADIRS and for the maintenance task (for example, if the GPS is not available and you are not at your usual airport). To find easily the local data for longitude and latitude (to align the ADIRS), you can print out the Post Flight Report (PFR). On the PFR header, you usually find the origin-destination city pair. Enter the 4 letters of the destination city, via the MCDU scratchpad line, in the "FROM" and "TO" fields of the INIT page, e.g. "KFJK/KJFK". Then push the ALIGN IRS prompt key.

UGB13131 - U7ST0M0 - UM34D3000000001



MAINTENANCE TIPS

ISIS D/O (3)

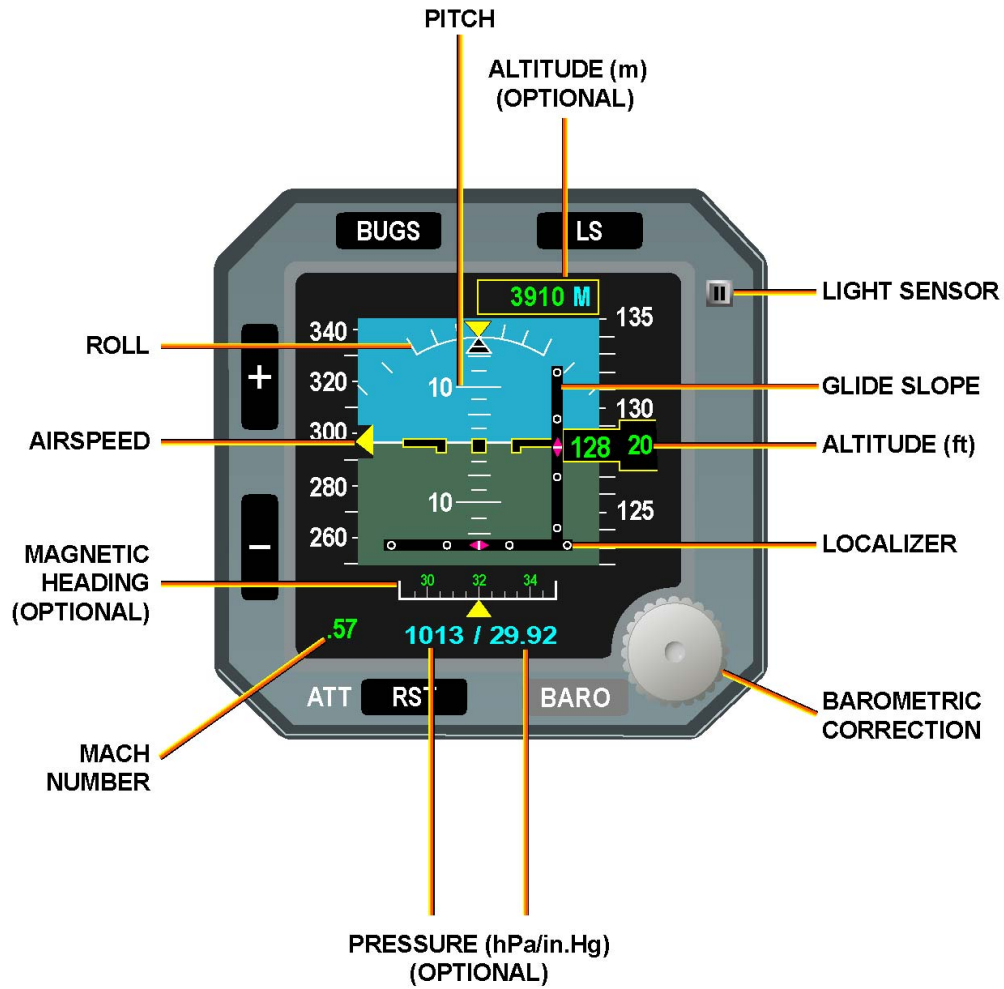
GENERAL

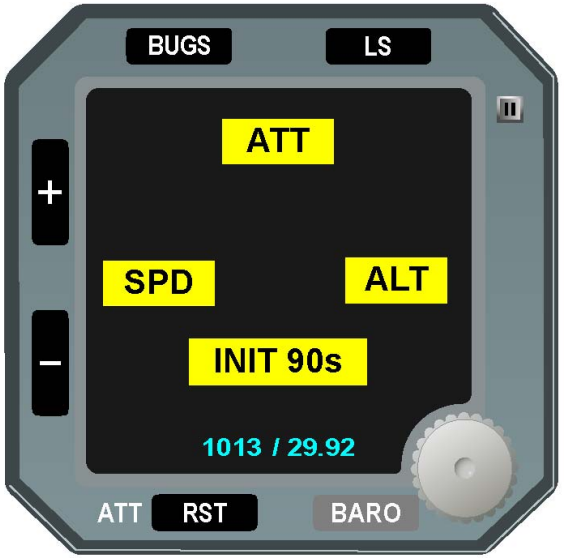
The Integrated Standby Instrument System (ISIS) is a combined standby altimeter, horizon indicator and AirSpeed Indicator (ASI). It displays the following information:
- airspeed,
- mach number,
- pitch and roll angles,
- altitude in feet,
- Glide Slope (G/S) and LOCalizer deviations.
- BAROmetric reference in hectopascals (hPa).

Optionally, it displays:
- metric altitude,
- magnetic heading,
- BARO correction in inches of mercury in addition to the BARO correction in hectopascals.

A light sensor on the ISIS front face automatically controls the display brightness. As soon as the ISIS is energized, it shows the initialization display for 90 s. This display has four yellow boxes indicating ATTitude, SPeeD, ALTitude and INIT 90 s.

UGB13131 - U7ST0M0 - UM34D4000000001





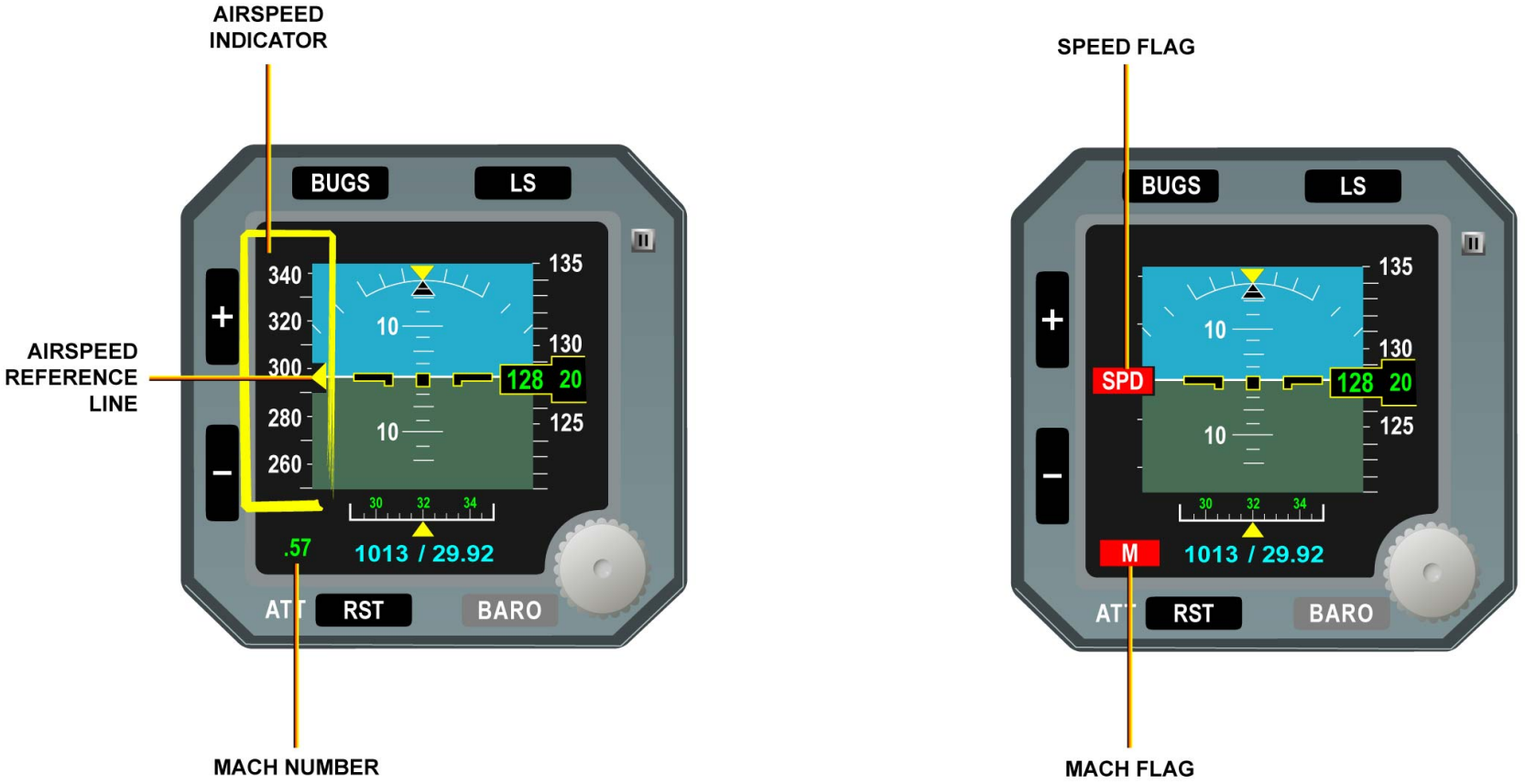
INITIALISATION DISPLAY

ISIS D/O (3)

STANDBY AIRSPEED INDICATOR FUNCTION

The standby airspeed indicator function measures the pitot/static pressure differential from the standby air data system and gives the airspeed indication in knots (kts). The airspeed indicator is shown vertically with a linear scale from 0 to 520 kts. This scale moves up and down in front of a fixed yellow triangle indicating the A/C actual airspeed. When the airspeed data is not valid, the airspeed scale is replaced by a red SPD flag. When the mach number is above 0.5, it is shown in green in the left bottom part of the display area, just below the speed scale. In case of failure, a red M flag is shown instead of the mach number.

UGB13131 - U7ST0M0 - UM34D4000000001



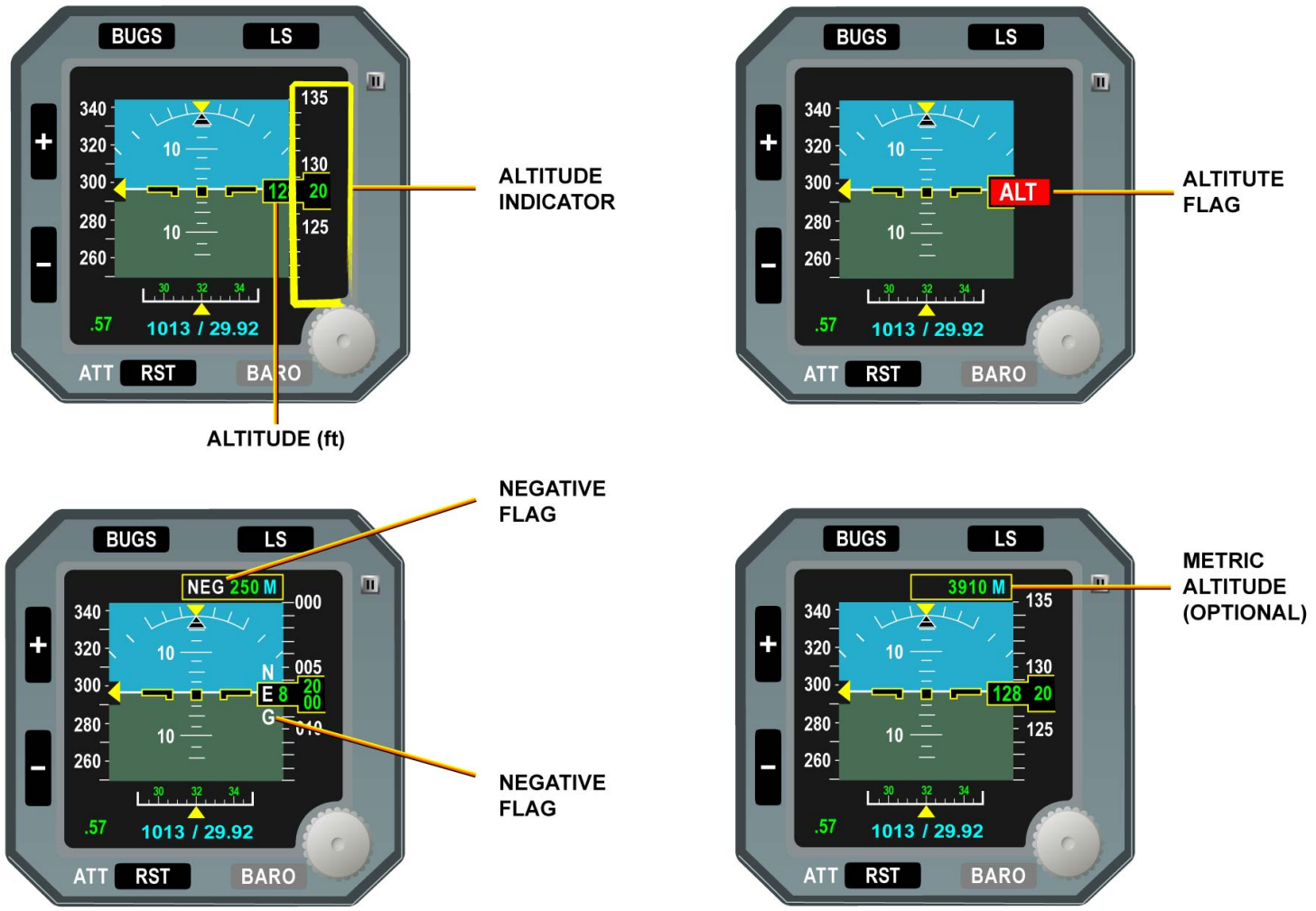
STANDBY AIRSPEED INDICATOR FUNCTION

ISIS D/O (3)

STANDBY ALTIMETER FUNCTION

The standby altimeter indication is supplied with static pressure by the standby air data system to indicate the barometric altitude of the aircraft in feet (ft). The altitude indicator is shown vertically with a linear scale from - 2.000 to + 50.000 ft. This altitude scale moves up and down behind a window with a yellow border indicating the A/C actual altitude value in green digits. When the altitude data is not valid, the altitude scale is replaced by a red ALT flag. If the altitude is NEGative, the NEG indication is shown in white near the digital read-out. The range is - 2.000 to 0 ft. Optionally the metric altitude is shown in the right top part of the display in addition to the altitude in feet. The metric altitude indication is shown in green by means of the digital read-out surrounded in yellow. The cyan letter M is written next to the altitude value. In case of negative altitude, the NEG indication is shown in white in front of the metric altitude value.

UGB13131 - U7ST0M0 - UM34D4000000001



STANDBY ALTIMETER FUNCTION

ISIS D/O (3)

REFERENCE BAROMETRIC PRESSURE INDICATION

Pushing the BARO reference selector knob in the bottom right corner of the indicator lets the crew select the standard BARO pressure. STD is shown in cyan below the attitude display in the bottom center of the display. Pushing it again makes the selection of the QNH (sea level atmospheric pressure) BARO reference in hectopascals. The selected BARO correction value is shown in cyan in place of STD. Rotating the BARO selector knob sets the corrected value in the range from 745 to 1100 hPa. Optionally the BARO correction value can be shown in inches of mercury (in.Hg). It is shown in cyan, in addition to the BARO correction value in hectopascal. The BARO selector knob is used for the display and the adjustment of the reference BARO correction in the range from 22 to 32.48 in.Hg.

UGB13131 - U7ST0M0 - UM34D4000000001

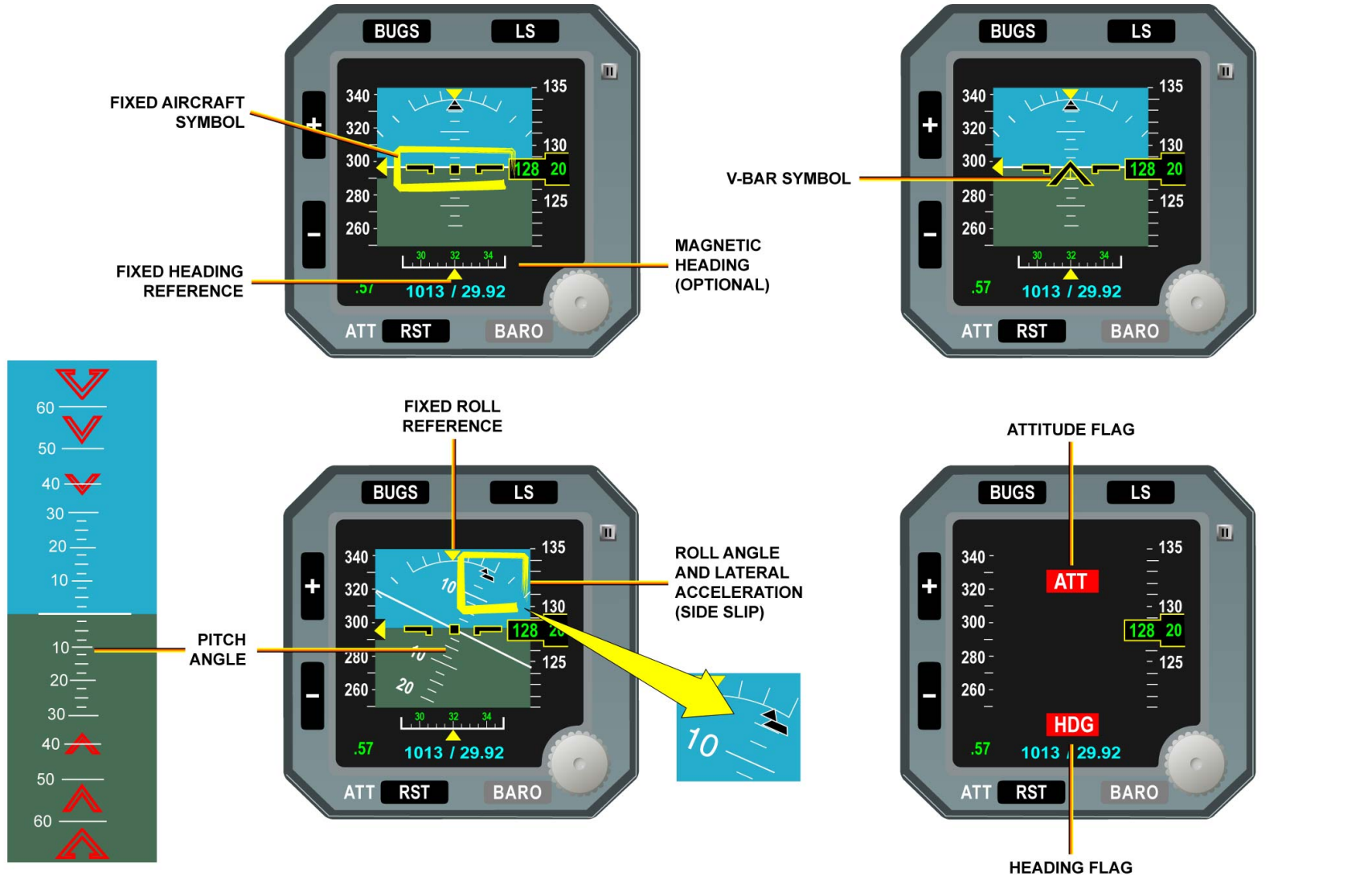
REFERENCE BAROMETRIC PRESSURE INDICATION

ISIS D/O (3)

STANDBY HORIZON

The A/C symbol is in black and outlined in yellow. It gives a fixed reference for the moving pitch scale and roll indication. The basic A/C symbol can be optionally replaced by the V-bar symbol when the related pin-program discrete is grounded. Pitch angles are shown with reference to the fixed A/C symbol. At angles greater than 30 degrees nose up or down, red large arrow heads indicate an excessive attitude and the direction to follow in order to reduce the pitch angle. Roll angle is shown with reference to a fixed roll scale and yellow triangle as index. The scale has white marks at 10, 20, 30, 45 and 60 degrees on either side of the zero position, which is indicated by a small black triangle with white outline, it is the roll indicator. As the A/C rolls left and right, the roll angle indicator moves across the fixed scale. A trapezoidal index, which can move beneath the roll indicator, represents the A/C lateral acceleration (sideslip). In case of failure of the pitch or roll information, the attitude display is replaced by a red ATT flag. The optional magnetic heading display is a moving white scale against a fixed yellow triangle as reference. In case of failure of the magnetic heading information, the magnetic heading display is replaced by a red HDG flag.

UGB13131 - U7ST0M0 - UM34D4000000001



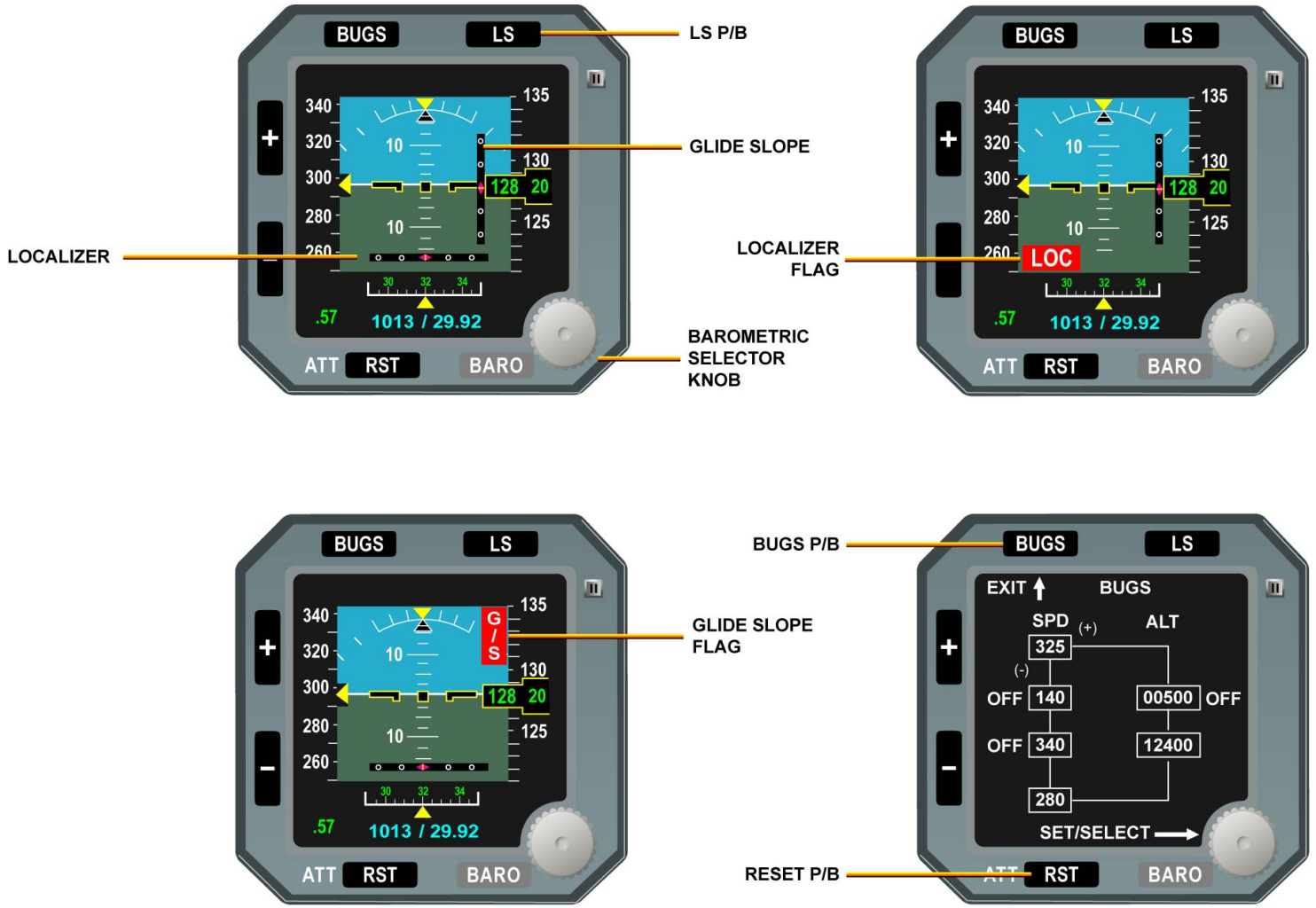
STANDBY HORIZON

ISIS D/O (3)

LS AND BUGS FUNCTION

When the Landing System P/B located on the right top part of the indicator is pushed the G/S and the LOC scales come into view. In case of failure of the G/S or LOC information, the related display is replaced by a red G/S or LOC flag. Pushing the BUGS P/B shows the BUGS display. This display is used to program characteristic speeds and altitudes displayed on the related speed and altitude scales. Pushing the BARO selector knob de-activates a bug and the OFF indication is shown next to the de-activated bug. Pushing it again re-activates the bug. Rotating the BARO selector knob sets the required bug value. Pushing the (-) P/B enables to move down to the next bug and the (+) P/B to move up to the previous bug. The ReSeT P/B is used to reset the attitude values during stabilized flight (no pitch or roll angles and with stabilized speed). It is also used in the different menus, as a "return" function.

UGB13131 - U7ST0M0 - UM34D4000000001



LS AND BUGS FUNCTION

ISIS D/O (3)

ISIS MENUS

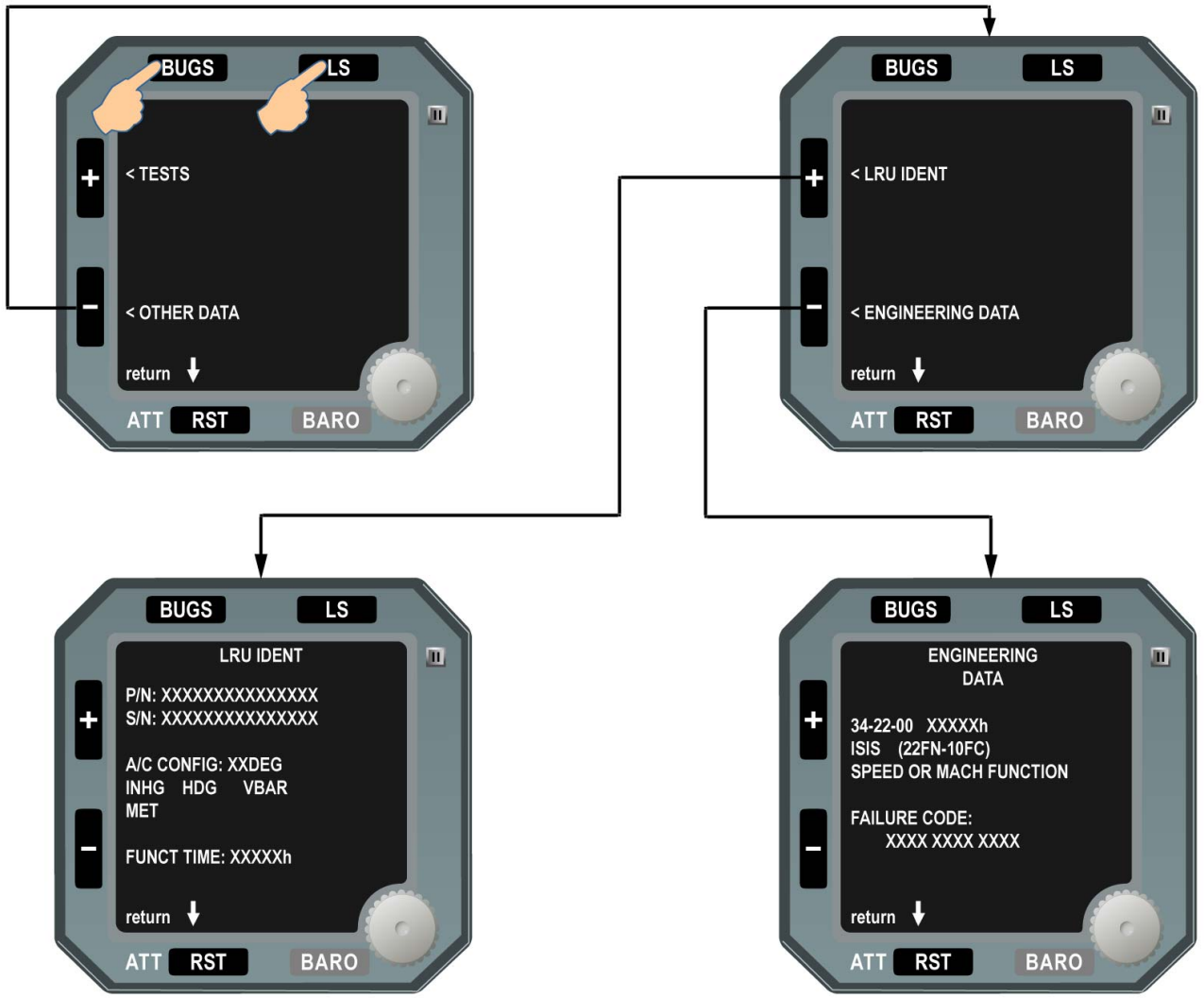
The ISIS indicator is able to display maintenance data when the BUGS and LS P/Bs are pushed simultaneously at least 2 s. In this case, a menu with two items is shown on screen: TESTS and OTHER DATA. The P/Bs adjacent to these items give access to the related menus. The OTHER DATA menu is made of two items: LRU IDENT and ENGINEERING DATA. When the (+) P/B next to the LRU IDENT item is pushed, the display shows the:
- ISIS Part Number (PN) and the Serial Number (SN),
- A/C configuration (active options),
- functional time counter (operating hours).

When the (-) P/B next to ENGINEERING DATA is pushed, the display shows the:
- ATA reference and time,
- component identification and Functional Item Number (FIN),
- failure code data.

If there is more than one data page, pushing the (+) or (-) P/Bs enables to go to the next or previous data pages. Pushing the RST P/B enables to return to the previous menu page. Pushing the RST P/B several times restores the operational display. The TESTS menu gives access to the FUNCTIONAL TEST and DISPLAY TEST.

NOTE: The ISIS has an internal flight/ground logic, which manages the BITE function and prevents maintenance mode activation in flight. The test is inhibited when the Calibrated Air Speed (CAS) is greater than 60 kts.

UGB13131 - U7ST0M0 - UM34D4000000001


BUGS
LS
< TESTS
< OTHER DATA
return
ATT
RST
BARO
BUGS
LS
< LRU IDENT
< ENGINEERING DATA
return
ATT
RST
BARO
BUGS
LS
LRU IDENT
P/N: XXXXXXXXXXXXXX
S/N: XXXXXXXXXXXXXX
A/C CONFIG: XXDEG
INHG HDG VBAR
MET
FUNCT TIME: XXXXXh
return
ATT
RST
BARO
BUGS
LS
ENGINEERING
DATA
34-22-00 XXXXXh
ISIS (22FN-10FC)
SPEED OR MACH FUNCTION
FAILURE CODE:
XXXX XXXX XXXX
return
ATT
RST
BARO

ISIS MENUS

ISIS INTERFACES (3)

CONNECTORS DESCRIPTION

On the back of the Integrated Standby Instrument System (ISIS) there are two pressure connections and one electrical connector. To avoid "cross connection" the pressure connectors are keyed and color-coded: Red for total pressure and yellow for static pressure. The electrical connector is for power supply, pin programming and systems interface. The normal power supply is 28V DC from the DC ESSential BUS. If DC ESS BUS is not available, a back-up of 28V DC is automatically supplied from the HOT BATtery BUS if airspeed is greater than 50 kts.

PERIPHERALS

INPUTS

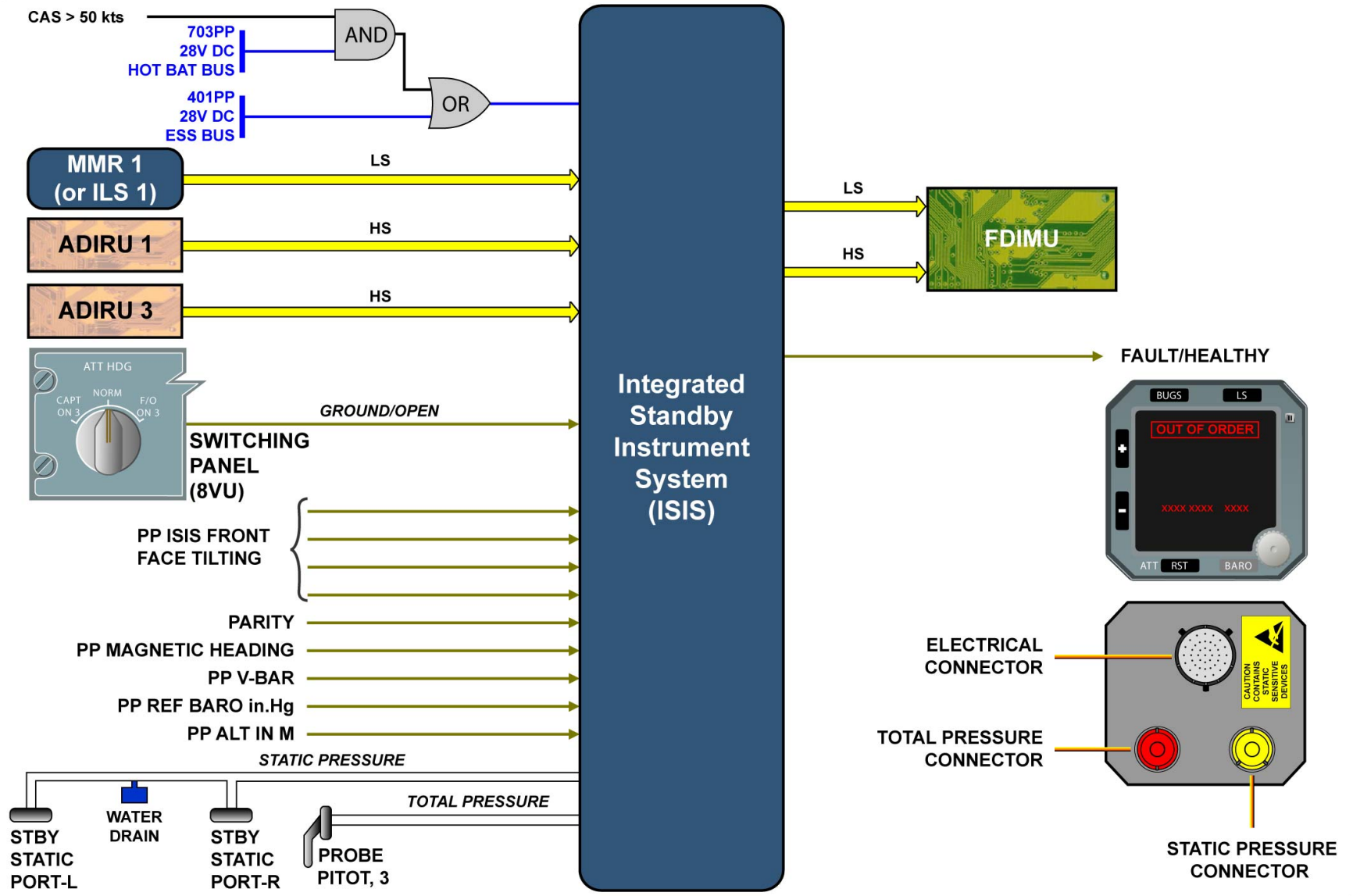
The ISIS receives data from several systems. Via ARINC 429 buses the ISIS is connected to:
- the Instrument Landing System (ILS) or Multi-Mode Receiver (MMR) for localizer and glide slope signals,
- the Air Data/Inertial Reference Unit (ADIRU) 1 and 3 for the reception of the optional magnetic heading data.

An ARINC 429 input is reserved as system provision (not shown).
Through discrete inputs the ISIS receives signals:
- from the ATTitude HeaDinG selector switch on the SWITCHING panel for selection of active ADIRU 1 (normal mode) or 3 (alternate mode),
- for the display of the optional reference BAROmetric pressure in inches of mercury in addition to the reference BARO in hectopascals,
- for the display of the optional altitude value in meter in addition to the altitude value in feet,
- which enable to change the basic aircraft symbol by the V-bars symbol as an option,
- for the ISIS indicator face tilting (4 discretes),
- for parity control of all the discretes.

OUTPUTS

All the data received and computed by the ISIS is sent to the Flight Data Interface and Management Unit (FDIMU) through one ARINC 429 high-speed bus for inertial data transmission and one low-speed bus for anemometric data transmission. One discrete output is used for fault/healthy indication. In case of a fatal failure of the ISIS the red message OUT OF ORDER associated with the related fault code is shown.

UGB13131 - U7ST0M0 - UM34F1000000001



CONNECTORS DESCRIPTION & PERIPHERALS

ISIS BITE AND TEST (3)

ISIS BITE TEST

JOB SET-UP

Put the A/C in maintenance configuration:
- energize the A/C electrical circuits,
- do the Air Data/Inertial Reference System (ADIRS) start procedure,
- open, safety and tag the NAVigation/STandBY/INSTrument C/B on the overhead C/B panel 49VU,
- remove the safety clip and the tag and close the NAV/STBY/INST C/B.

On the Integrated Standby Instrument System (ISIS) indicator, make sure that:
- the INIT 90 s indication comes into view,
- the functions page comes into view.

UGB13131 - U7ST0M0 - UM34Y1000000001

BITE Test of the ISIS indicator

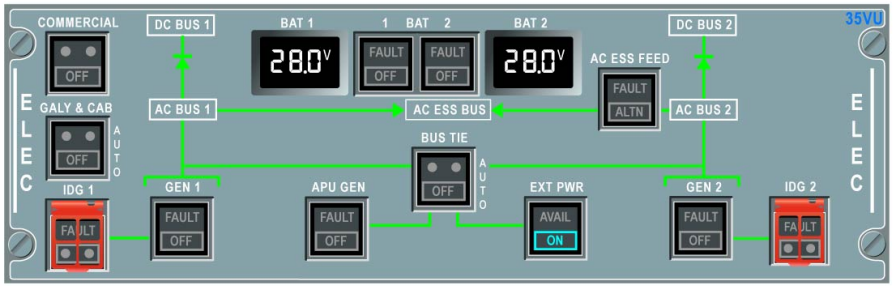
Job Set-up

- Aircraft Maintenance Configuration
- Open, safety and tag this circuit breaker
- Remove the safety clip and the tag and close this circuit breaker
- Aircraft Maintenance Configuration

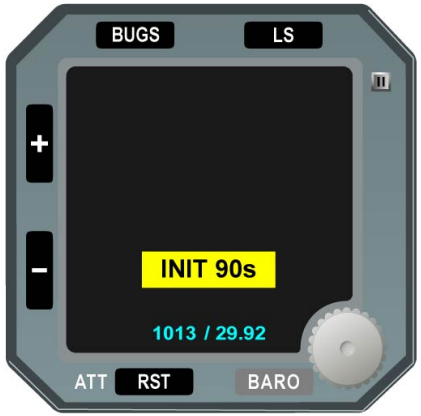
Procedure

BITE test of the ISIS indicator

Close-up

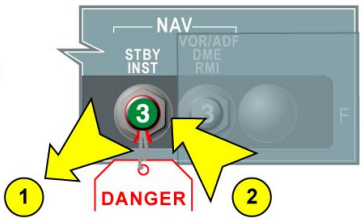


ADIRS MSU



MAGNETIC HEADING (OPTIONAL)

PRESSURE (hPa/in.Hg) (OPTIONAL)



OVERHEAD C/B PANEL (49VU)

ISIS BITE TEST - JOB SET-UP

ISIS BITE AND TEST (3)

ISIS BITE TEST (continued)

PROCEDURE

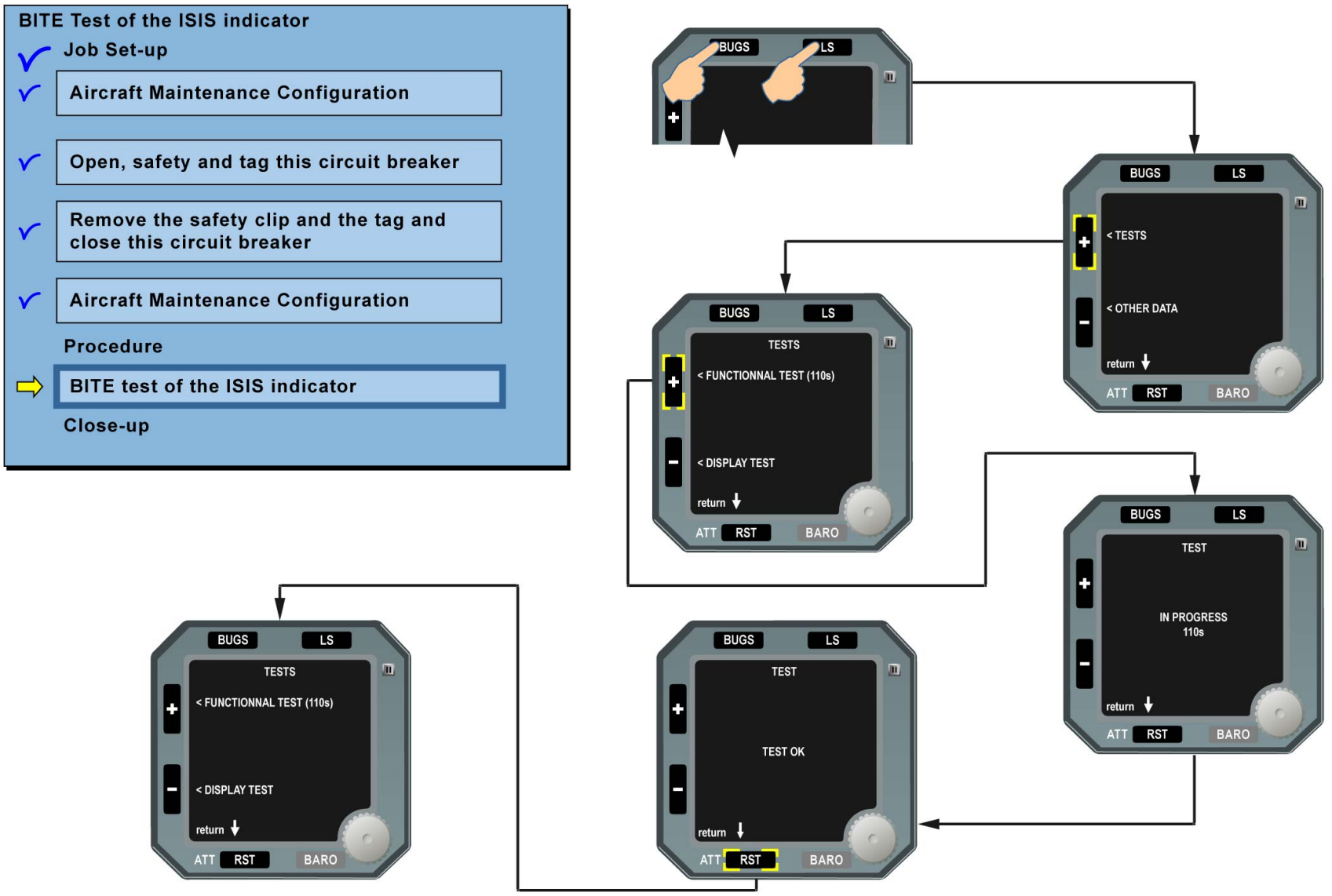
On the center instrument panel 401VU, on the ISIS indicator:
- push the BUGS and the LS P/Bs at the same time and hold them pushed for more than 2 s,
- push the P/B adjacent to the TESTS indication,
- push the P/B adjacent to the FUNCTIONAL TEST (110s) indication.

At the end of the test, the TEST OK indication comes into view,

NOTE: Do not move the A/C during the alignment period of this test (110 s).

- push the ReSeT P/B until the previous menu page comes into view.

UGB13131 - U7ST0M0 - UM34Y1000000001



ISIS BITE TEST - PROCEDURE

ISIS BITE AND TEST (3)

ISIS BITE TEST (continued)

CLOSE-UP

Put the A/C back to its initial configuration:
Do the ADIRS stop procedure and de-energize the A/C electrical circuits.

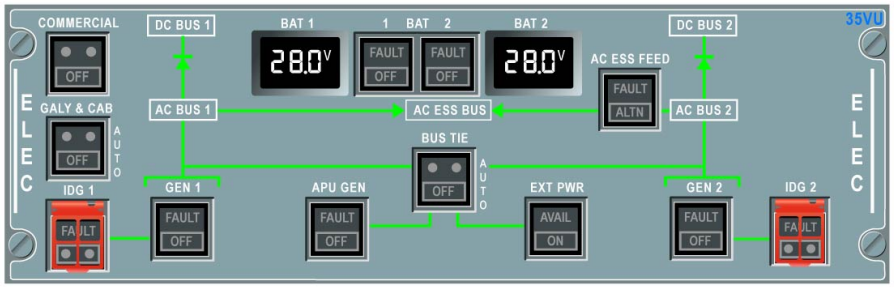
UGB13131 - U7ST0M0 - UM34Y1000000001

BITE Test of the ISIS indicator

- ✓ Job Set-up
- ✓ Aircraft Maintenance Configuration
- ✓ Open, safety and tag this circuit breaker
- ✓ Remove the safety clip and the tag and close this circuit breaker
- ✓ Aircraft Maintenance Configuration
- ✓ Procedure
- ✓ BITE test of the ISIS indicator
- ⇨ Close-up

ADIRS MSU

TASK COMPLETED



ISIS BITE TEST - CLOSE-UP

MMR SYSTEM PRESENTATION (2)

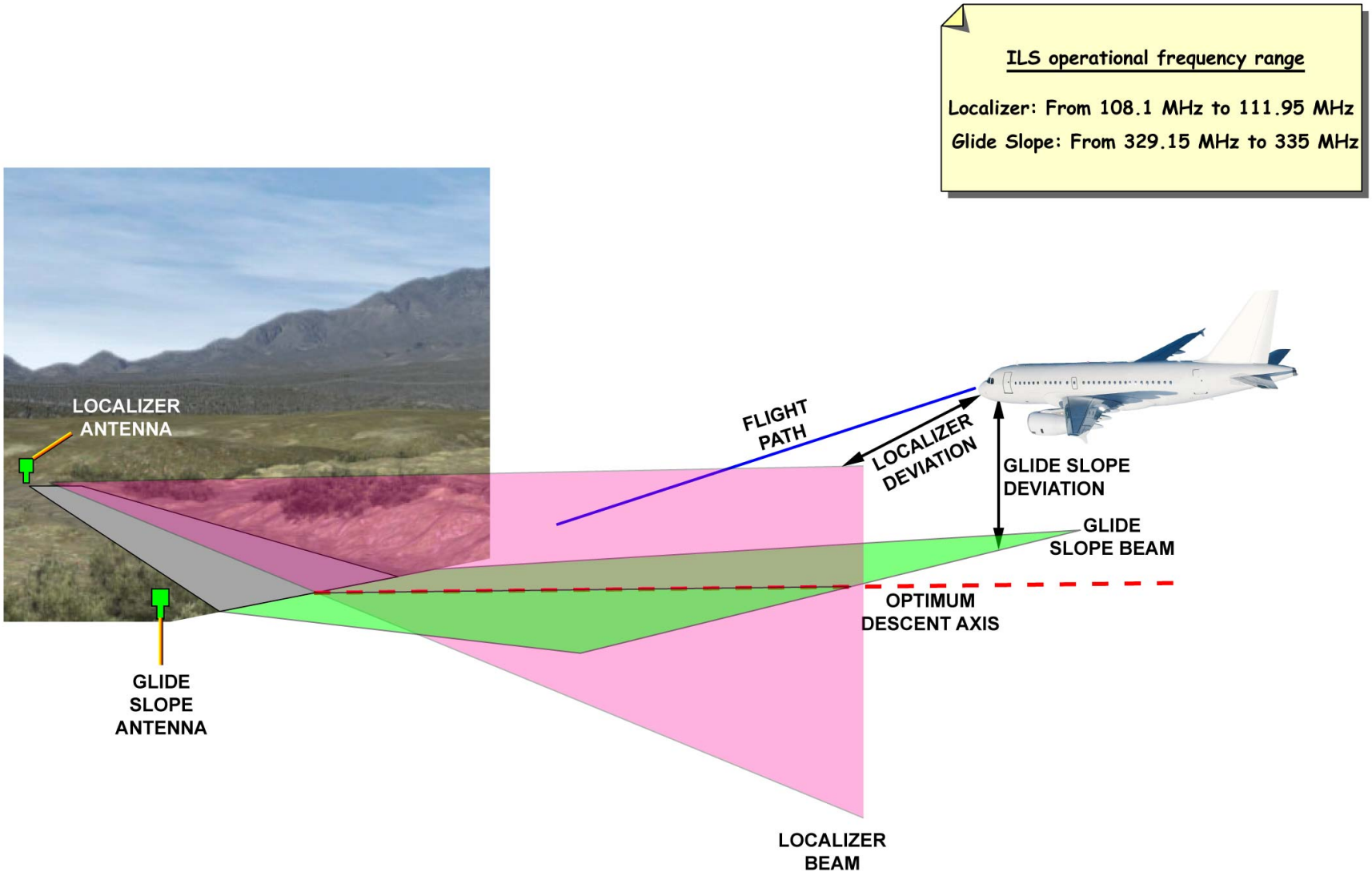
GENERAL

The Multi-Mode Receiver (MMR) system is a navigation sensor with 3 internal receivers: MMR = ILS + GPS.

ILS PRINCIPLE

The function of the ILS is to supply to the crew and airborne system users, signals transmitted by ground stations. A descent axis is determined by the intersection of a Localizer beam (LOC) and a Glide Slope beam (G/S) created by these ground stations at known frequencies. The ILS can measure and display angular deviations and it also receives the Morse audio signal, which identifies the ILS ground stations.

UGB13131 - U7ST0M0 - UM34P4000000001



GENERAL & ILS PRINCIPLE

MMR SYSTEM PRESENTATION (2)

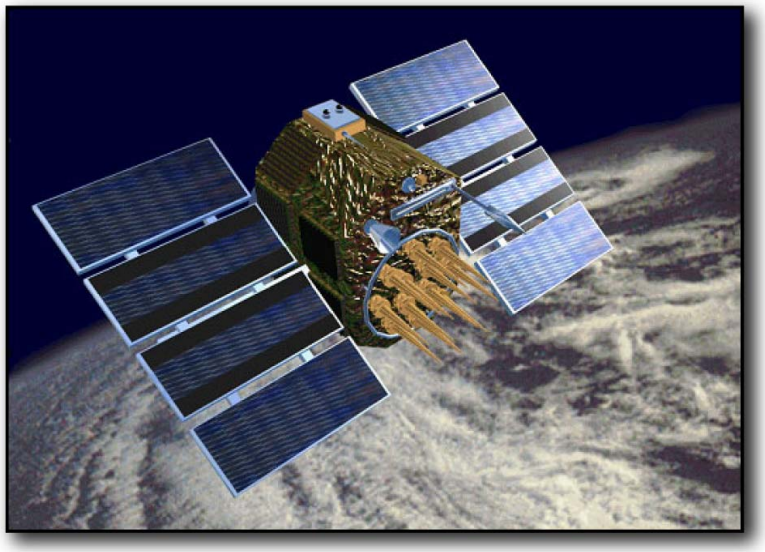
GPS PRINCIPLE

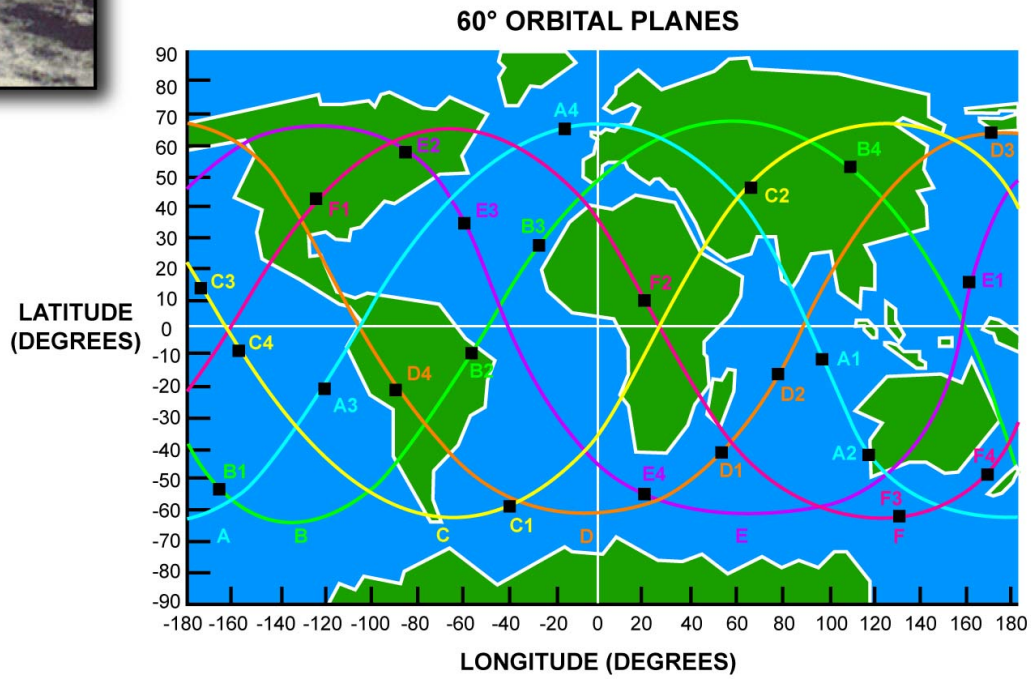
The NAV System Time And Ranging (STAR) GPS is a worldwide navigation radio aid which uses satellite signals to provide accurate navigation information. The architecture of the system is composed of 3 parts called segments:
- spatial segment,
- control segment,
- user segment.

SPATIAL SEGMENT

The spatial segment is composed of a constellation of 24 satellites. These satellites are arranged in six separate orbital planes of four satellites each on a circular orbit. These orbits have the following characteristics:
- 55° inclination to the Equator,
- an altitude of approximately 20.200 km with an orbital period of 12 sidereal hours.

These satellites give:
- the satellite position (ephemeris of the constellation),
- the constellation data (almanach),
- the atmospheric corrections.





GPS PRINCIPLE - SPATIAL SEGMENT

MMR SYSTEM PRESENTATION (2)

GPS PRINCIPLE (continued)

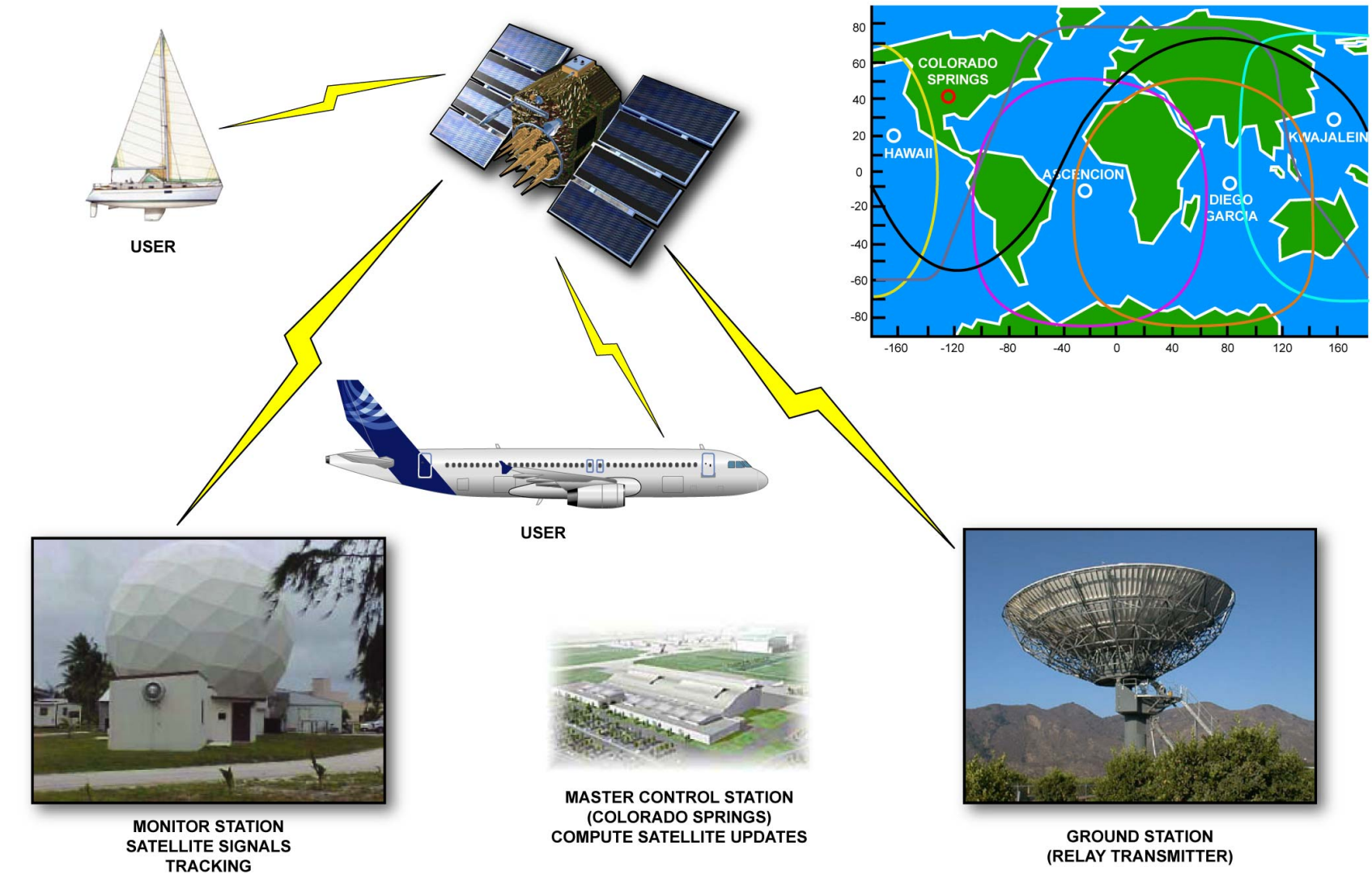
CONTROL SEGMENT

The control segment is composed of four monitor stations and one master control station which track the satellites, compute the ephemeris, correct the clock and control the navigation parameters and transmit them to the GPS users. The four monitor stations are located at:

- Kwajalein (Marshall islands in Pacific ocean),
- Hawaii (Pacific ocean),
- Ascencion Island (Atlantic ocean),
- Diego Garcia (Indian ocean).

The master control station is located at Colorado Springs (USA).

UGB13131 - U7ST0M0 - UM34P4000000001



GPS PRINCIPLE - CONTROL SEGMENT

MMR SYSTEM PRESENTATION (2)

GPS PRINCIPLE (continued)

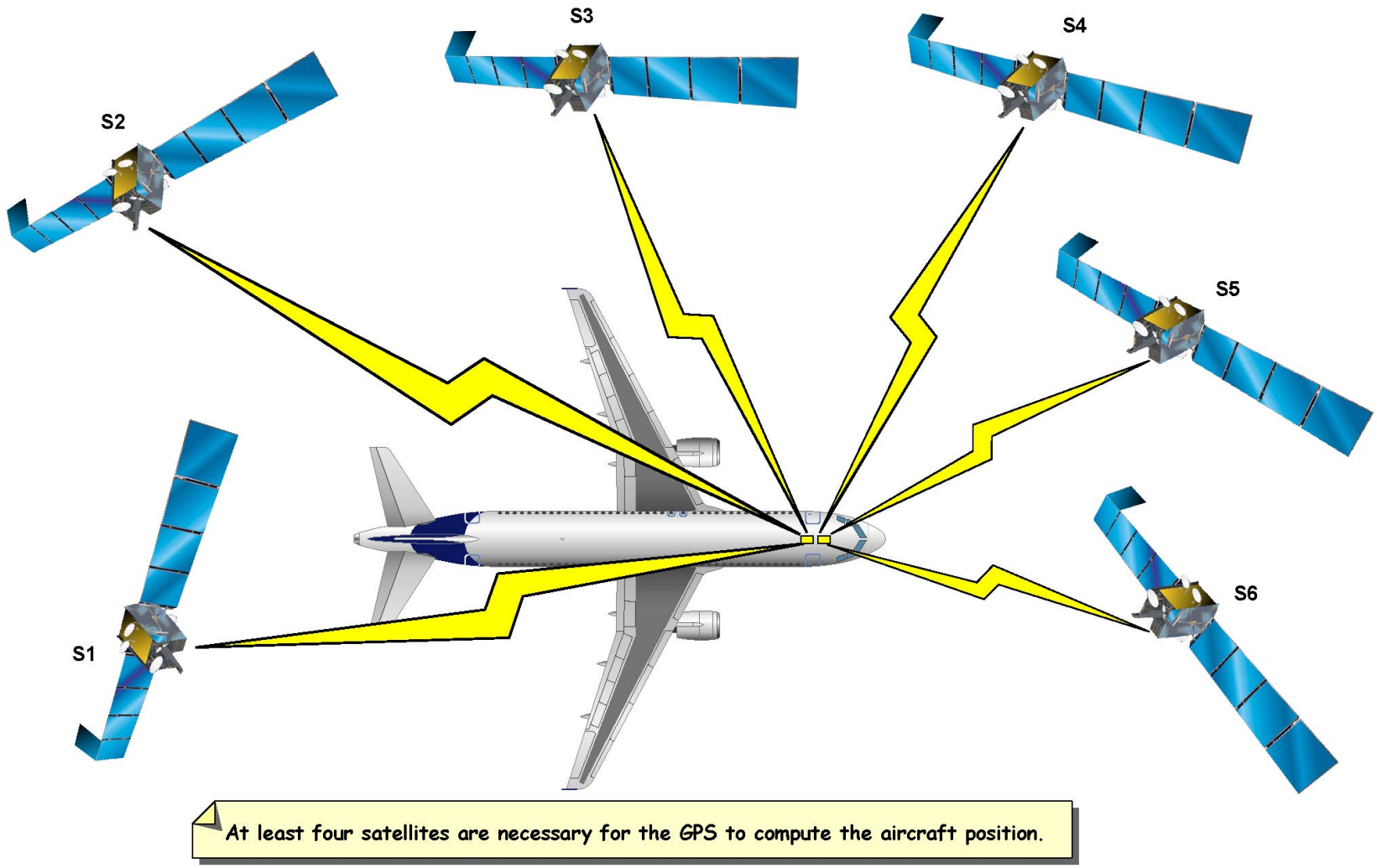
USER SEGMENT

The principle of GPS position computation is based on the measurement of transmission time of the GPS signals broadcast by at least four satellites. This segment is constituted by the GPS receiver and allows:

- signal acquisition,
- distance calculation,
- navigation computation (Satellite choice, positioning, propagation corrections),
- detection and isolation of failed satellites.

NOTE: When GPS mode is active, no VOR/DME/ADF data is used for navigation.

UGB13131 - U7ST0M0 - UM34P4000000001



GPS PRINCIPLE - USER SEGMENT

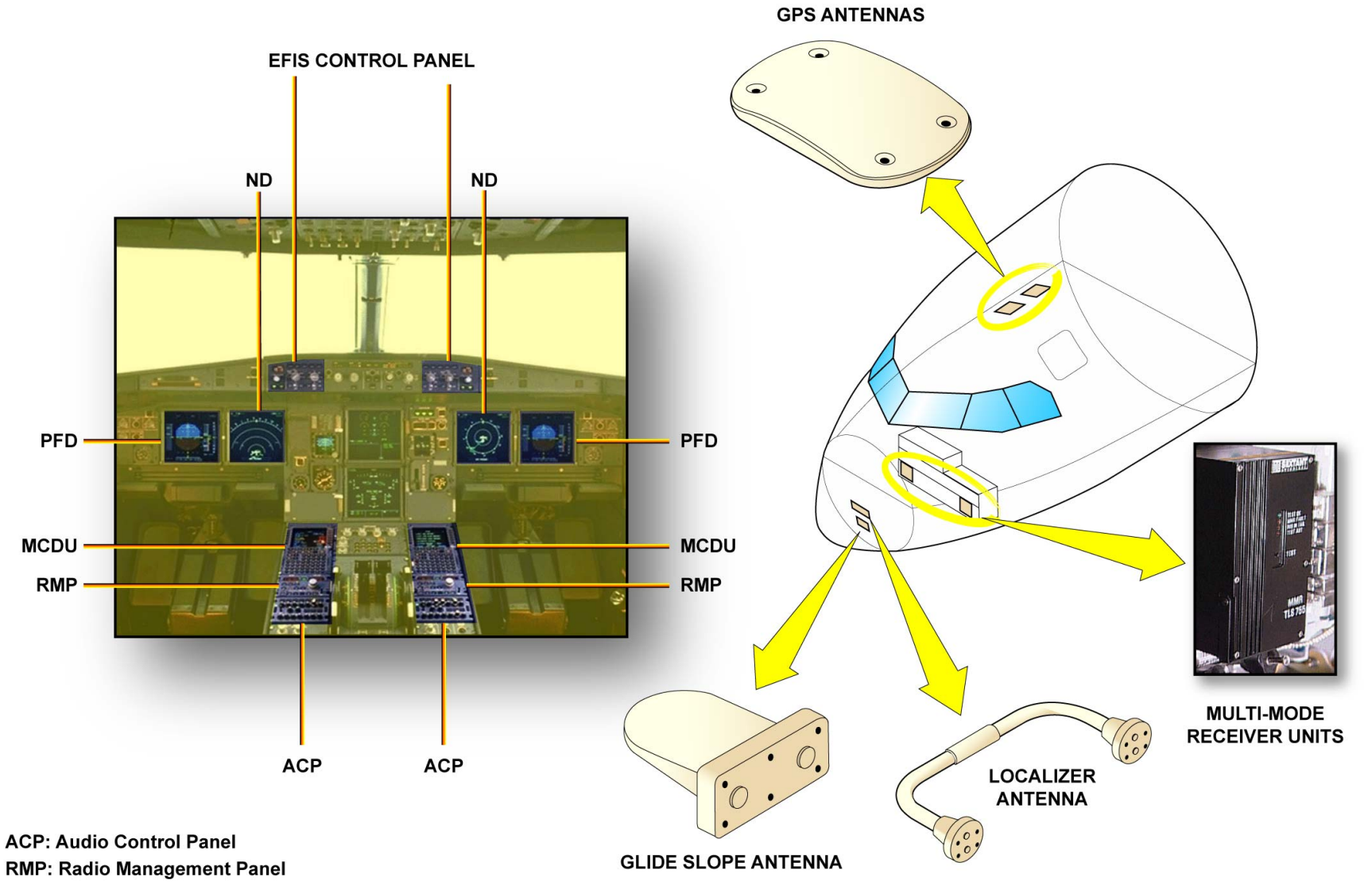
MMR SYSTEM PRESENTATION (2)

COMPONENTS

The components are one dual LOC antenna, one dual G/S antenna, two GPS antennas and two MMR units. The MMR system interfaces with:
- PFDs and NDs for display,
- EFIS control unit for display and ILS control,
- Flight Management and Guidance Computers (FMGCs), for ILS auto-tuning and GPS position,
- MCDUs for ILS manual tuning,
- CAPT and F/O Radio Management Panels (RMPs) for ILS back-up tuning,
- Audio Control Panels (ACPs) for ILS audio signal,
- Air Data/Inertial Reference Units (ADIRUs) for GP-IRS hybrid position computation.

The Multi-mode Receivers are in the forward avionics bay 90VU. The Multi-mode Receiver antennas are installed on the upper fuselage for the GPS function and in the radome for the G/S and LOC dual antennas.

UGB13131 - U7ST0M0 - UM34P4000000001


EFIS CONTROL PANEL
ND
ND
PFD
PFD
MCDU
MCDU
RMP
RMP
ACP
ACP
ACP: Audio Control Panel
RMP: Radio Management Panel
GPS ANTENNAS
MULTI-MODE
RECEIVER UNITS
LOCALIZER
ANTENNA
GLIDE SLOPE ANTENNA

COMPONENTS

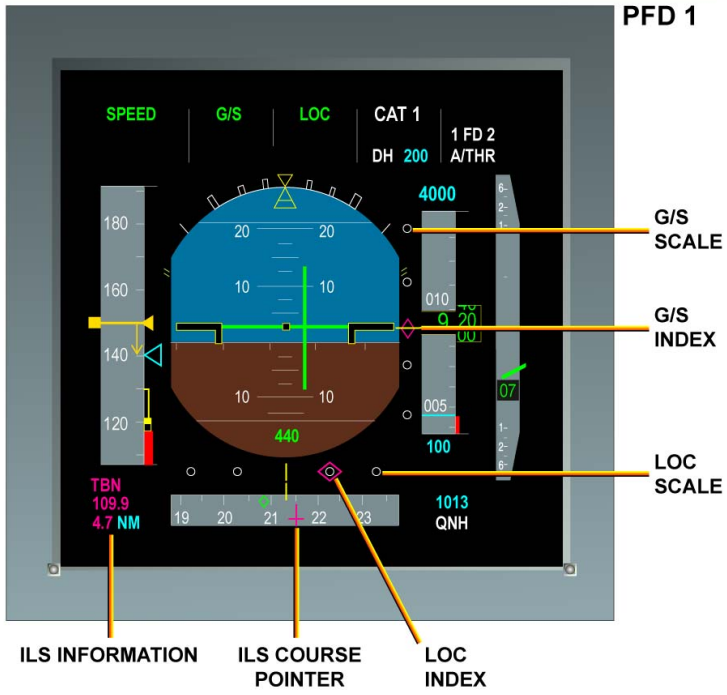
MMR SYSTEM PRESENTATION (2)

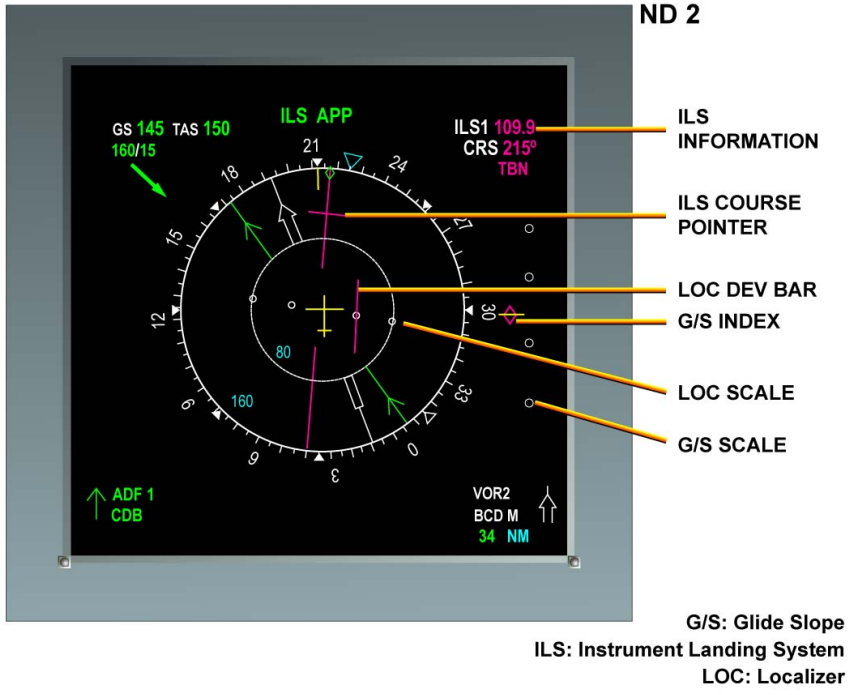
ILS INDICATING

The ILS data appears on the PFD as soon as the LS P/BSW on the EFIS control panel has been pressed in, and on the ND when ROSE/LS mode has been selected. ILS information is displayed in magenta. The ILS 1 information is displayed on PFD 1 and ND 2. The ILS 2 information is displayed on PFD 2 and ND 1.

UGB13131 - U7ST0M0 - UM34P4000000001

EFIS CONTROL PANEL
(13VU)





G/S: Glide Slope
ILS: Instrument Landing System
LOC: Localizer

ILS INDICATING

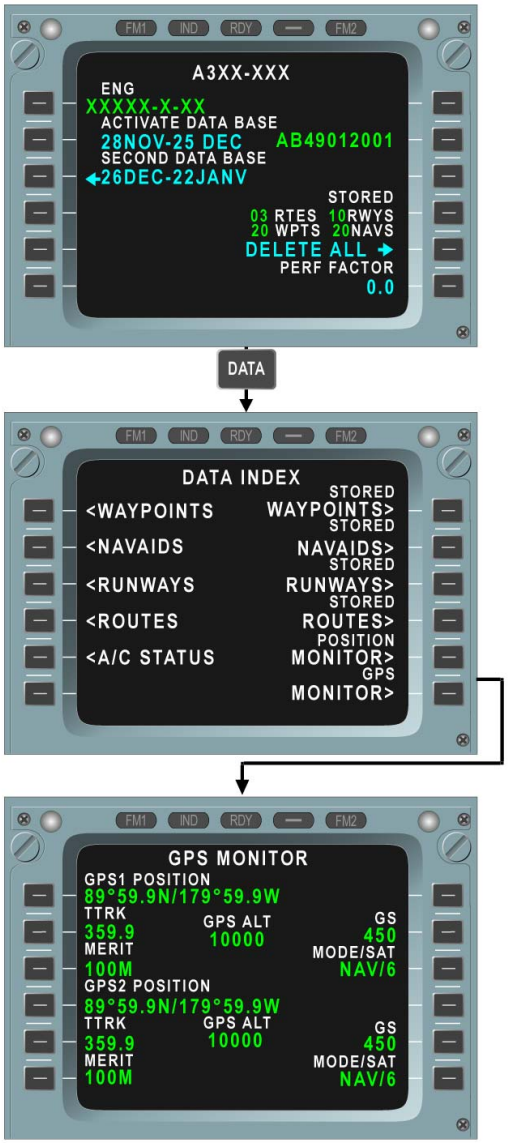
MMR SYSTEM PRESENTATION (2)

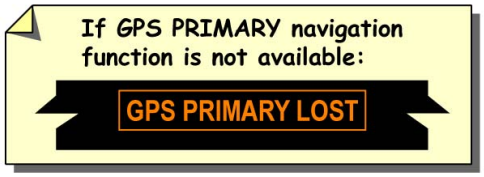
GPS INDICATING

The GPS data is displayed on the MCDUs and on the NDs. The GPS data on MCDU GPS MONITOR page are:
- GPS POSITION which gives the aircraft latitude and longitude,
- TTRK, which gives the aircraft true track,
- GPS ALT which gives the aircraft GPS altitude,
- MERIT for the figure of Merit in meters,
- GS, which gives the aircraft ground speed value,
- MODE/SAT, which indicates the number of satellites tracked and the mode used.

GPS message on ND gives information on the availability of the GPS primary navigation function.

UGB13131 - U7ST0M0 - UM34P4000000001





GPS INDICATING

MMR SYSTEM DESCRIPTION/OPERATION (3)

GENERAL

The Multi-Mode Receiver (MMR) system includes:
- 2 MMR units,
- 1 dual Glide Slope (G/S) antenna,
- 1 dual Localizer (LOC) antenna,
- 2 GPS antennas.

ILS FUNCTION

AUTO TUNING

In normal operation, the GPS 1 data are used by the Air Data/Inertial Reference Units (ADIRUs) 1 and 3; the GPS 2 data by the ADIRU 2.
In order to reduce GPS initialization time, the GPS 1 (2) receives data from the ADIRU 1(2).
The Inertial Reference (IR) portion of the ADIRU 1(2) gives to the FMGC 1(2):
- pure IR data,
- pure GPS data (in this case the ADIRU operates as a relay),
- hybrid GPIR data.

The FMGC 1(2) uses the hybrid GPIR 1(2) data for position fixing functions.
The pure GPS data are used for display on the MCDU 1 and 2.
In case of one GPS failure, the three ADIRUs automatically select the only operative GPS to compute hybrid GPIR data.
In case of one ADIRU 1 failure, the FMGC 1 uses ADIRU 3/GPS 1 data.
In case of one ADIRU 2 failure, the FMGC 2 uses ADIRU 3/GPS 2 data.
The primary source of ADIRU 3 being the GPS 1, it is necessary to select the secondary input port of the ADIRU 3 (GPS 2) by means of the ATT HDG selector switch (13FP) to preserve side 1/side 2 segregation (GPS 1/ADIRU 1/FMGC 1 and GPS 2/ADIRU 3/FMGC 2 architecture).
In case of failure of two ADIRUs, the two FMGCs use only the operative ADIRU.
This ADIRU receives data from its own side GPS (e.g. ADIRU 1. GPS 1).

MANUAL TUNING

From each MCDU both MMR units can be manually tuned through their onside FMGC.

NOTE: To return to the auto-tuning mode, the manual mode has to be cleared.

BACK-UP TUNING

In case of failure of both FMGCs, a back-up tuning is provided by RMP 1 and 2. Either RMP controls both MMR units, if NAV mode is activated by selecting NAV key on RMP 1 and 2. In this mode, the RMP 1 can control the MMR 2 through the RMP 2, which can control the MMR 1 through the RMP 1.

NOTE: RMP 3 is not used for navaids tuning.
In emergency electrical configuration only RMP 1 is supplied.

ANTENNAS

The dual G/S and dual LOC antennas are common to both MMR units. Each antenna has two independent connectors, for each MMR units.

GPS FUNCTION

GPS OPERATION

The GPS function is achieved by two stand-alone satellite navigation sensors using the US GPS satellites constellation. The GPS primary

function is to track the Radio Frequency (RF) signals received from the satellites, to compute its own position and to provide the GPS data to the FMGCs through the three ADIRUs. Receiver Autonomous Integrity Monitoring (RAIM) or Autonomous Integrity Monitoring Extrapolation (AIME) provides integrity and availability of this data. The GPS function provides three-dimensional aircraft position, velocities and exact time used for hybrid computations by the three ADIRUs. In case of failure of one GPS function, the ADIRU automatically selects the only operative GPS function to compute hybrid GP-IRS data.

ANTENNAS

The GPS antenna is an L-band active antenna, with an integrated preamplifier and filter, providing an omni-directional upper hemispheric coverage. The GPS antenna operates at a frequency of 1575.42 MHz called L1. A second frequency of 1227.6 MHz, called L2, is used to estimate the propagation error of L1 and to suppress it.

ADIRU

To reduce initialization time, MMR unit 1 and 2 receive position data (latitude, longitude), time and date from the associated ADIRU. In case of failure of ADIRU 2 the primary source of ADIRU 3 being GPS 1, it is necessary to select the second input port of ADIRU 3 (GPS 2) by means of the ATTitude/HeaDinG selector knob on the SWITCHING panel to preserve the side 1/side 2 segregation:
- MMR 1 provides data to FMGC 1 through ADIRU 1,
- MMR 2 provides data to FMGC 2 through ADIRU 3.

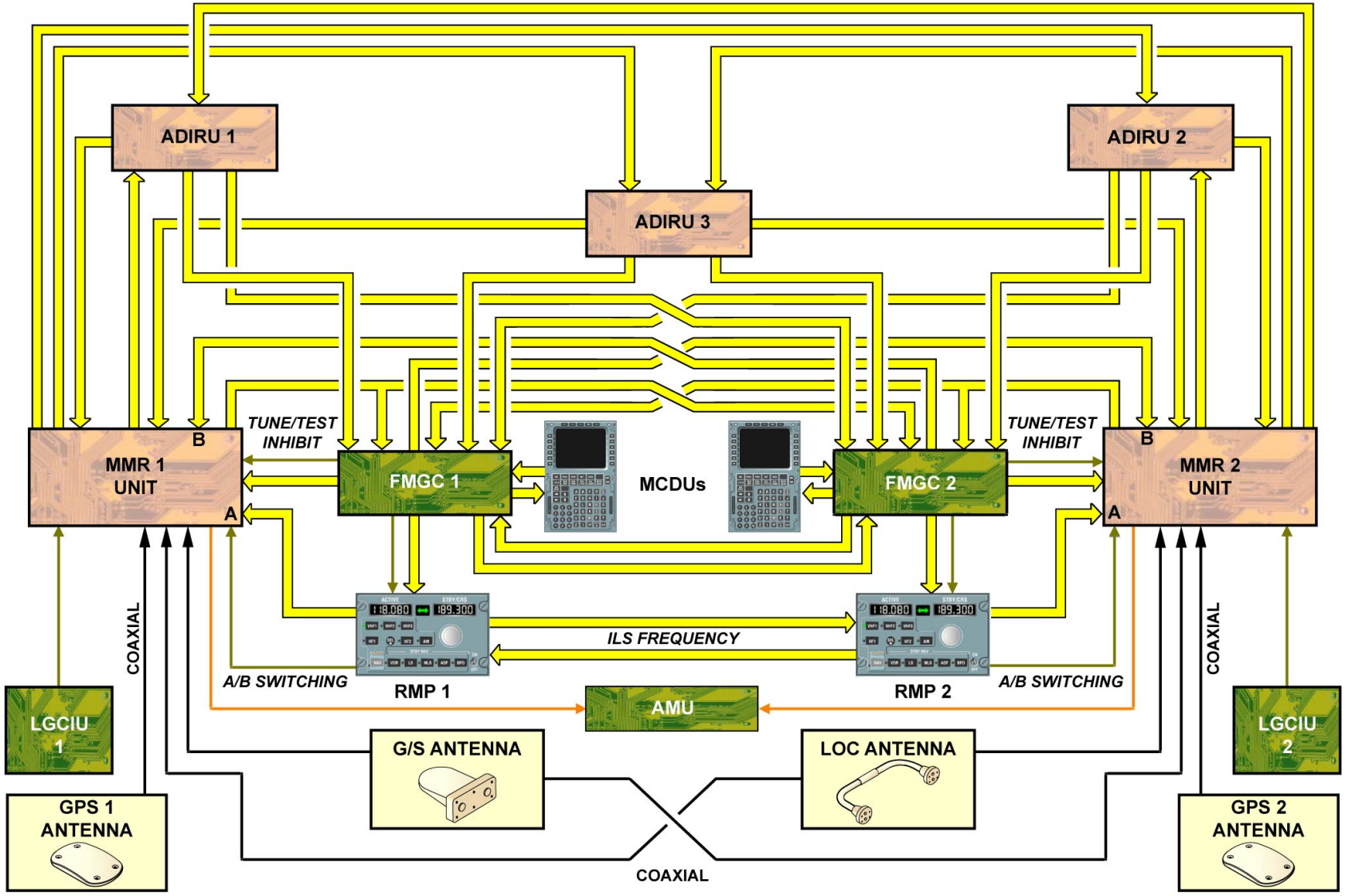
FMGC

The Inertial Reference (IR) portion of ADIRU 1 or 2 provides FMGC 1 or 2 with pure IR data, pure GPS data and hybrid GP-IRS data for position fixing. The FMGC position is a mix of the hybrid GPS/Inertial Reference System (IRS) position.

NOTE: As long as GPS/IRS mode is active, radio updating DME/DME or VOR/DME is not allowed.

LGCIU

Each Landing Gear Control and Interface Unit (LGCIU) sends a ground/flight discrete signal, which is used by the receiver BITE module to count the MMR internal flight legs.



GENERAL ... LGCIU

This Page Intentionally Left Blank

MMR SYSTEM DESCRIPTION/OPERATION (3)

CFDIU

The Centralized Fault Display Interface Unit (CFDIU) enables tests and trouble shooting to be carried out on the MMR system using the MCDU. The test can be done only on ground.

USERS

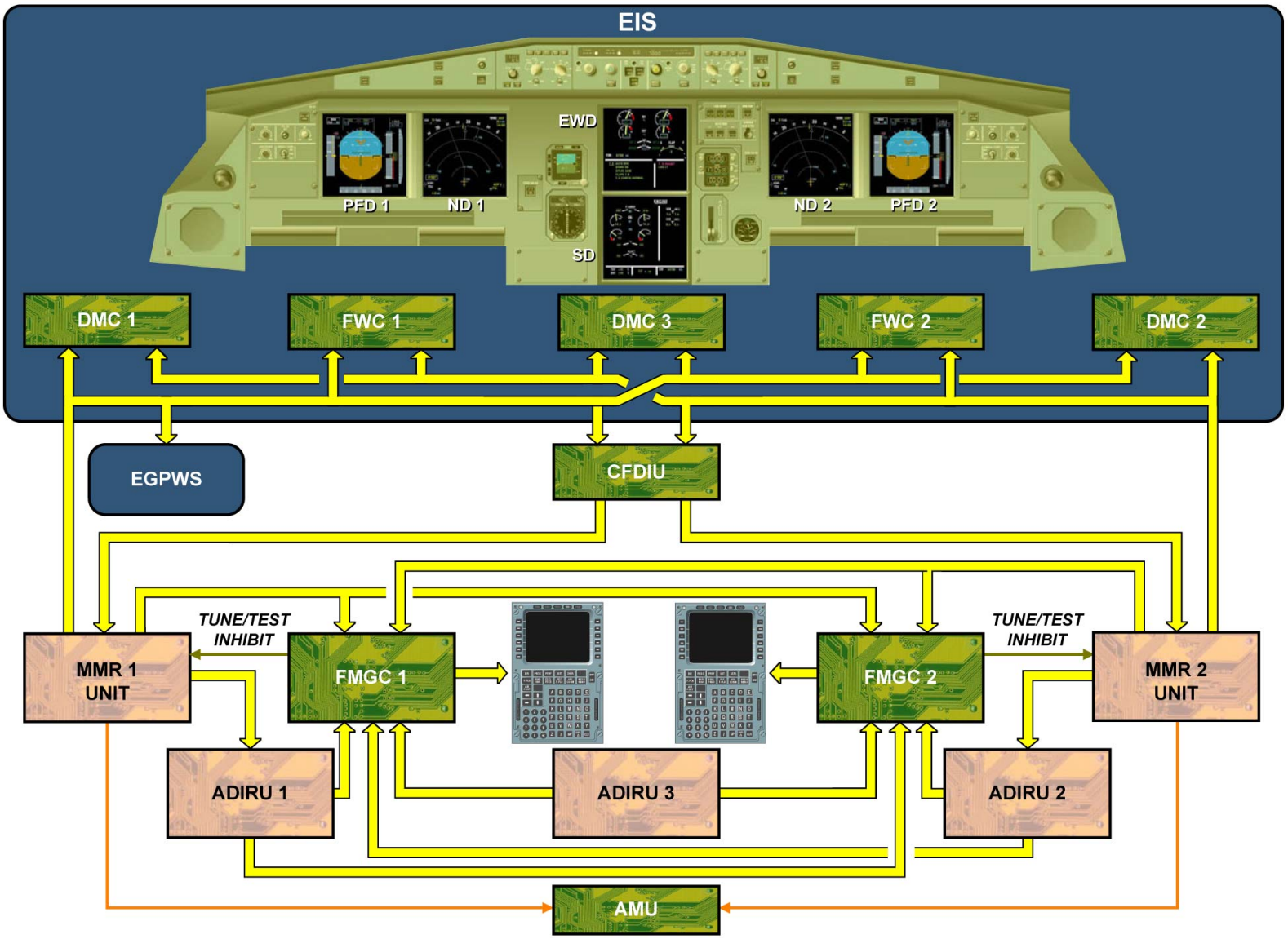
The MMR data is sent to the FMGCs for aircraft guidance during take off, approach and landing phases. The MMR data is also sent to the ECAM for warnings. The MMR 1 data is send to the Enhanced Ground Proximity Warning System (EGPWS) for mode 5 computation (descent below G/S).

NOTE: A discrete signal sent by the FMGC inhibits any frequency change in the MMR unit when LAND mode is armed below 700 ft.

INDICATING

The ILS 1 data is sent, through the Display Management Computers (DMCs), to the CAPT PFD and F/O ND and the ILS 2 data is sent to the F/O PFD and CAPT ND. An audio signal is also processed by the MMR unit (ILS part) and sent to the Audio Management Unit (AMU) so that it can be heard by the crew. Pure GPS data is available for display on the GPS MONITOR page of the MCDUs. Operational messages may also be displayed on the NDs.

UGB13131 - U7ST0M0 - UM34D7000000001



CFDIU ... INDICATING

WXR/PWS SYSTEM PRESENTATION (2)

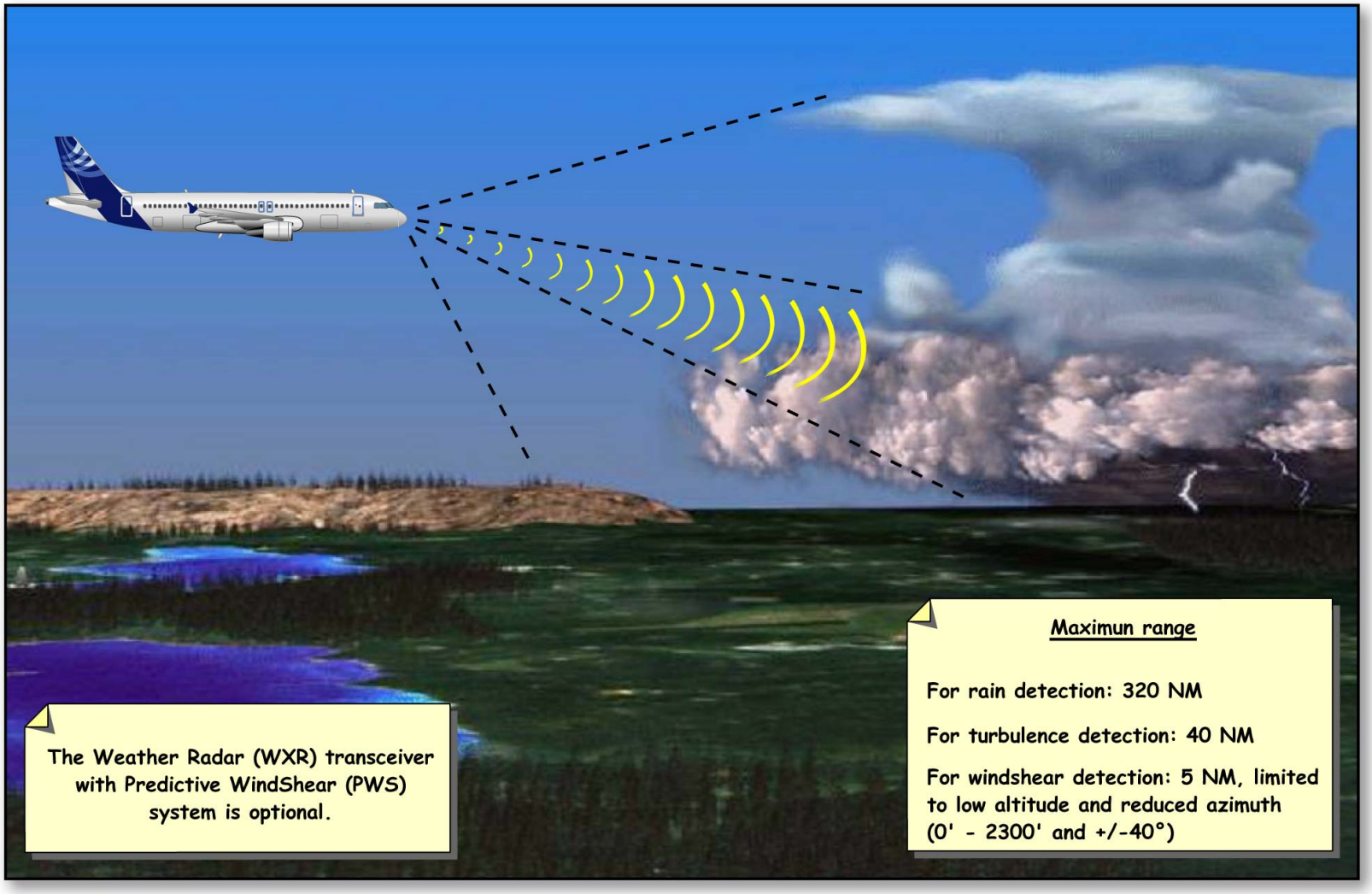
GENERAL

The airborne Weather Radar (WXR) and Predictive WindShear system (PWS) detects and localizes atmospheric wet disturbances and windshear events in the area scanned by the antenna.

WXR PRINCIPLE

The WXR helps the pilots to avoid these areas and the related turbulences by determining their range and bearing. It can also be used for ground mapping. The radar emits microwave pulses through a directive antenna, which receives the return signals that are the echoes. The distance is determined by the time necessary for the echoes to come back. The azimuth is given by the antenna position when the echo is received.

UGB13131 - U7ST0M0 - UM34P600000001

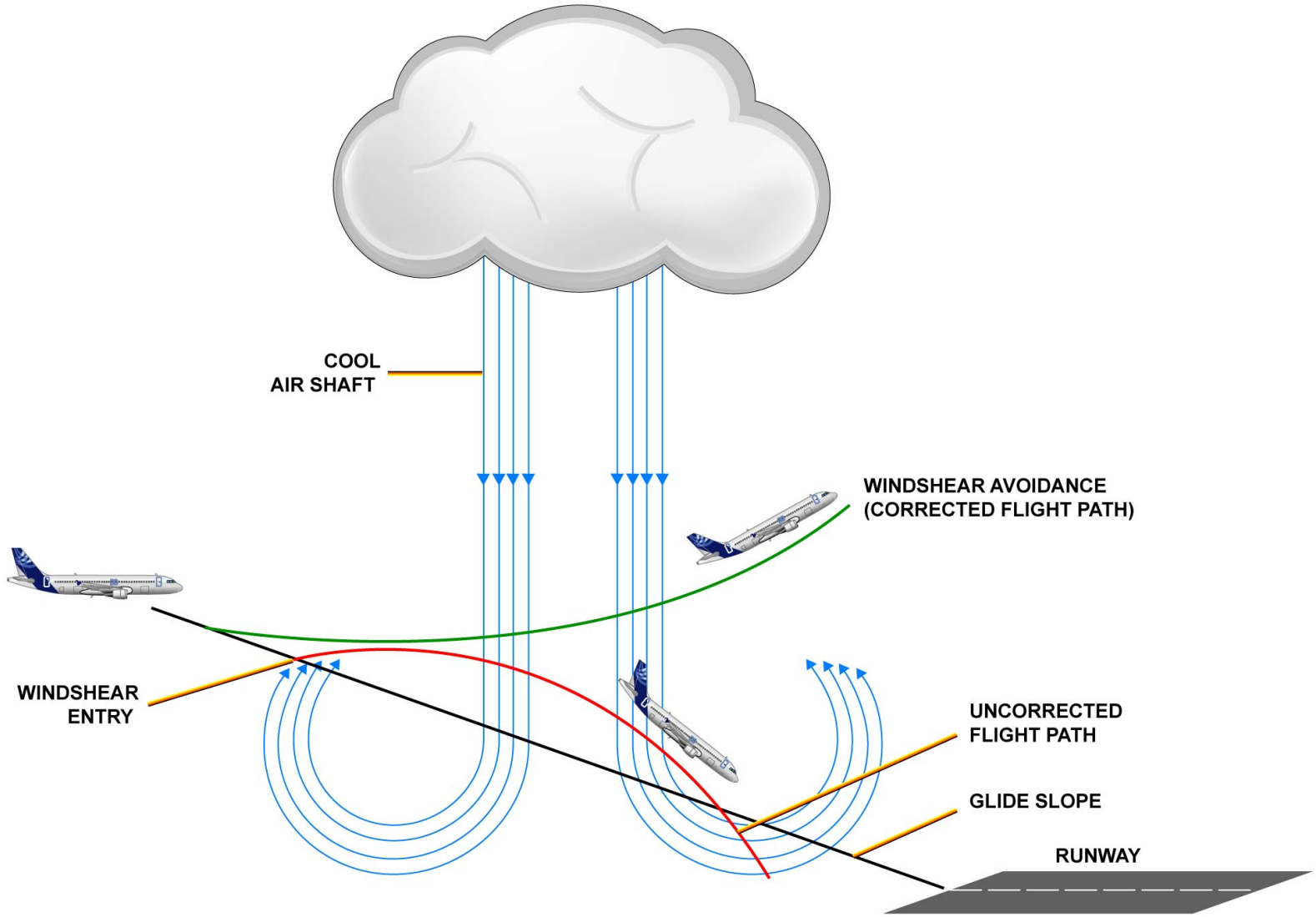

The Weather Radar (WXR) transceiver with Predictive WindShear (PWS) system is optional.
Maximun range
For rain detection: 320 NM
For turbulence detection: 40 NM
For windshear detection: 5 NM, limited to low altitude and reduced azimuth (0' - 2300' and +/-40°)

GENERAL & WXR PRINCIPLE

WXR/PWS SYSTEM PRESENTATION (2)

PWS PRINCIPLE

A windshear event is a sudden change of wind speed and/or direction over a small distance caused by downwards and/or upwards movement of the air. The most critical moment for the aircraft is near the ground level during the approach or in take-off. The PWS function detects the windshear event if measurable precipitation occurs during the event.



PWS PRINCIPLE

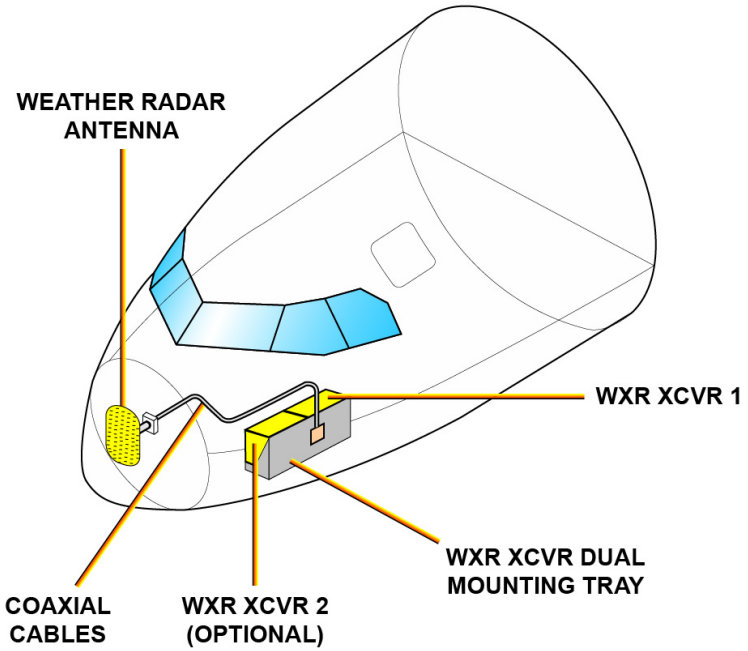
WXR/PWS SYSTEM PRESENTATION (2)

COMPONENTS

The primary components are:
- a weather radar transceiver,
- a weather transceiver mounting tray,
- a dual weather radar control unit,
- a single weather antenna drive,
- a weather radar antenna,
- a weather radar transmitter/receiver.

NOTE: The weather radar image is shown independently on the CAPT and F/O Navigation Displays (ND). The NDs are connected to the three Display Management Computers (DMC) and to the CAPT and F/O EFIS control panels of the Flight Control Unit (FCU).

UGB13131 - U7ST0M0 - UM34P600000001



WXR/PWS PANEL with MULTISCAN function

XCVR: Transceiver
WXR: Weather Radar

COMPONENTS

WXR/PWS SYSTEM PRESENTATION (2)

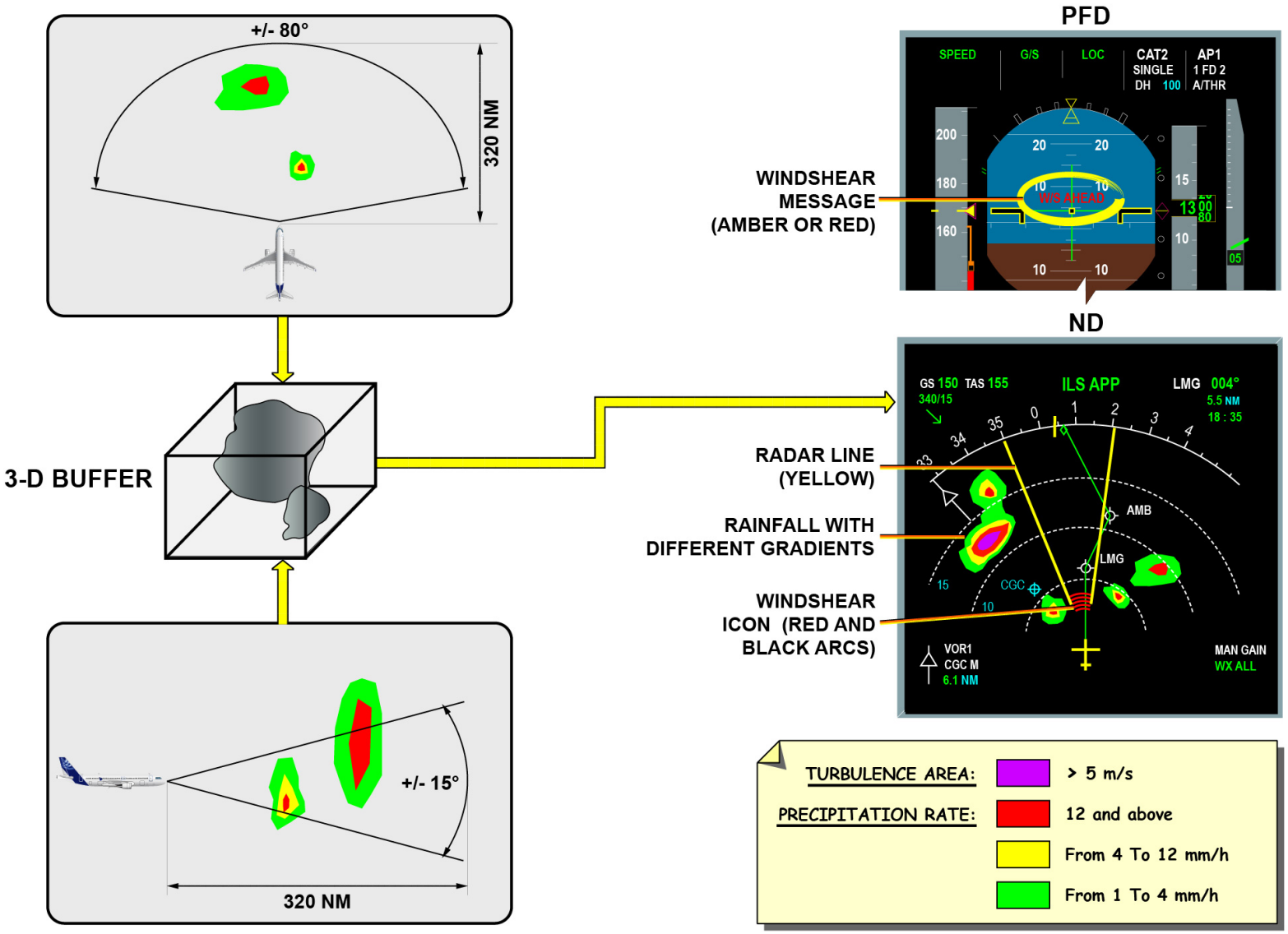
WXR INDICATING

RDR-4000 has a new 3D-Buffer technology, in which antenna scanning is not related to Navigation Display (ND). The system will continuously scan the atmosphere in front of the aircraft from 0 to 60,000 ft.
In automatic mode, RDR-4000 sends data about all detected weather cells to the ND. The cells that are not in the vertical flight path of the aircraft (called OFF PATH weather cells) are shown on the ND with hatched colors. The cells that are in the vertical flight path of the aircraft (called ON PATH cells) are shown in solid colors.
The pilots can also select an altitude layer that will be extracted and displayed on the ND. This is the constant elevation mode that is used for weather cell analysis.
When the system starts, a delay of 30 seconds is necessary before the 3D buffer is filled. There is a new display OFF mode which removes weather echo from the ND while the system scans the atmosphere and updates its 3D buffer.
The weather radar image is shown independently on the CAPT and F/O NDs.
The ND also shows mode messages related to the mode CAPT and F/O selection on the control panel (the CAPT mode selection is shown on the CAPT ND, the F/O selection is shown on the F/O ND).
The colors used to show the disturbance intensity are:
- black, green, yellow and red to show different precipitation rates,
- magenta to show the turbulence areas (maximum 40 NM).

PWS INDICATING

The predictive windshear indications and warning/caution alerts are shown on the CAPT and F/O PFDs and NDs. The windshear phenomenon is indicated by an icon superimposed on the radar image in the different EFIS modes, ARC and ROSE except in PLAN mode.

UGB13131 - U7ST0M0 - UM34P600000001



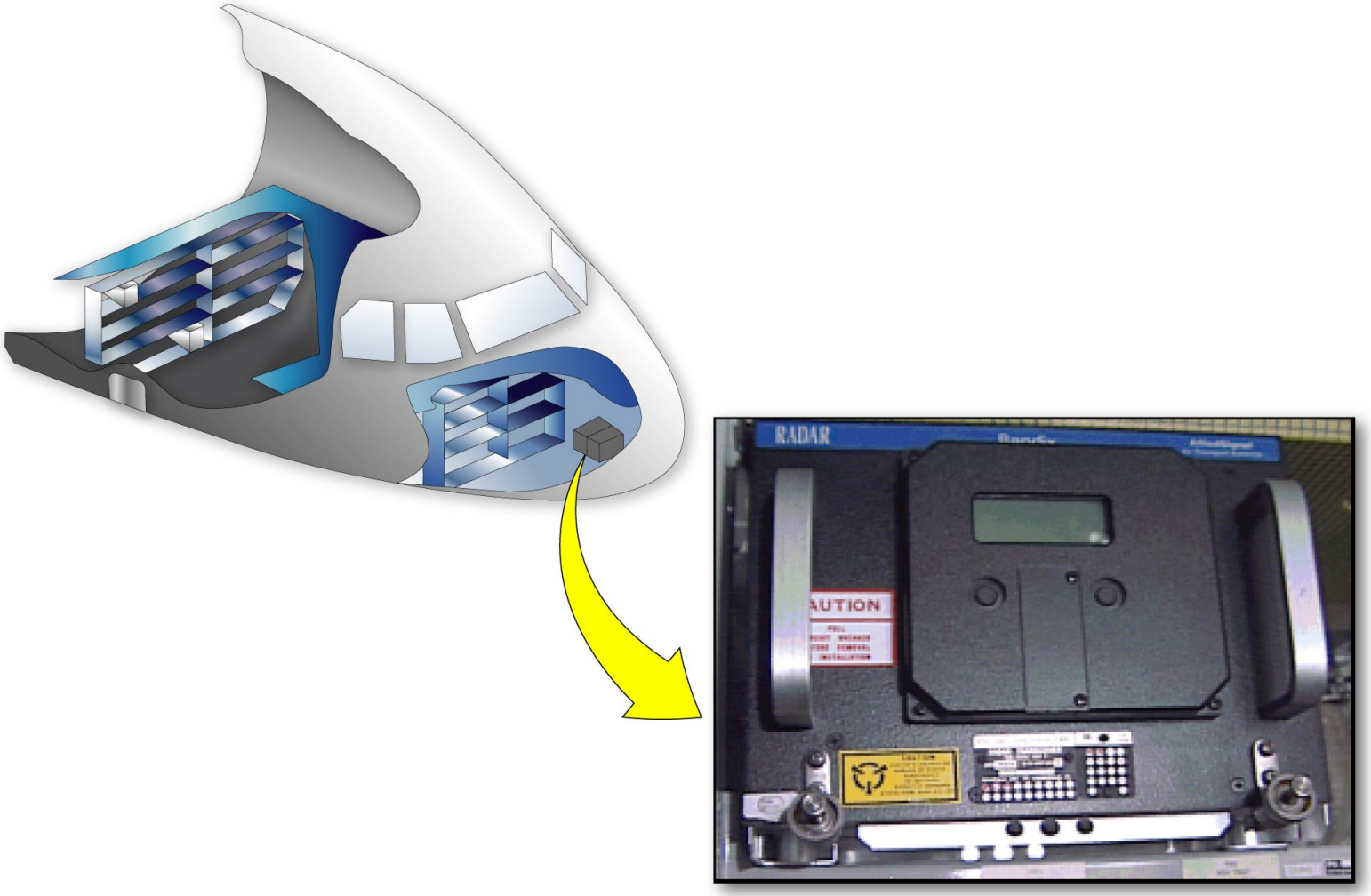
WXR INDICATING & PWS INDICATING

WXR/PWS SYSTEM PRESENTATION (2)

COMPONENT LOCATION

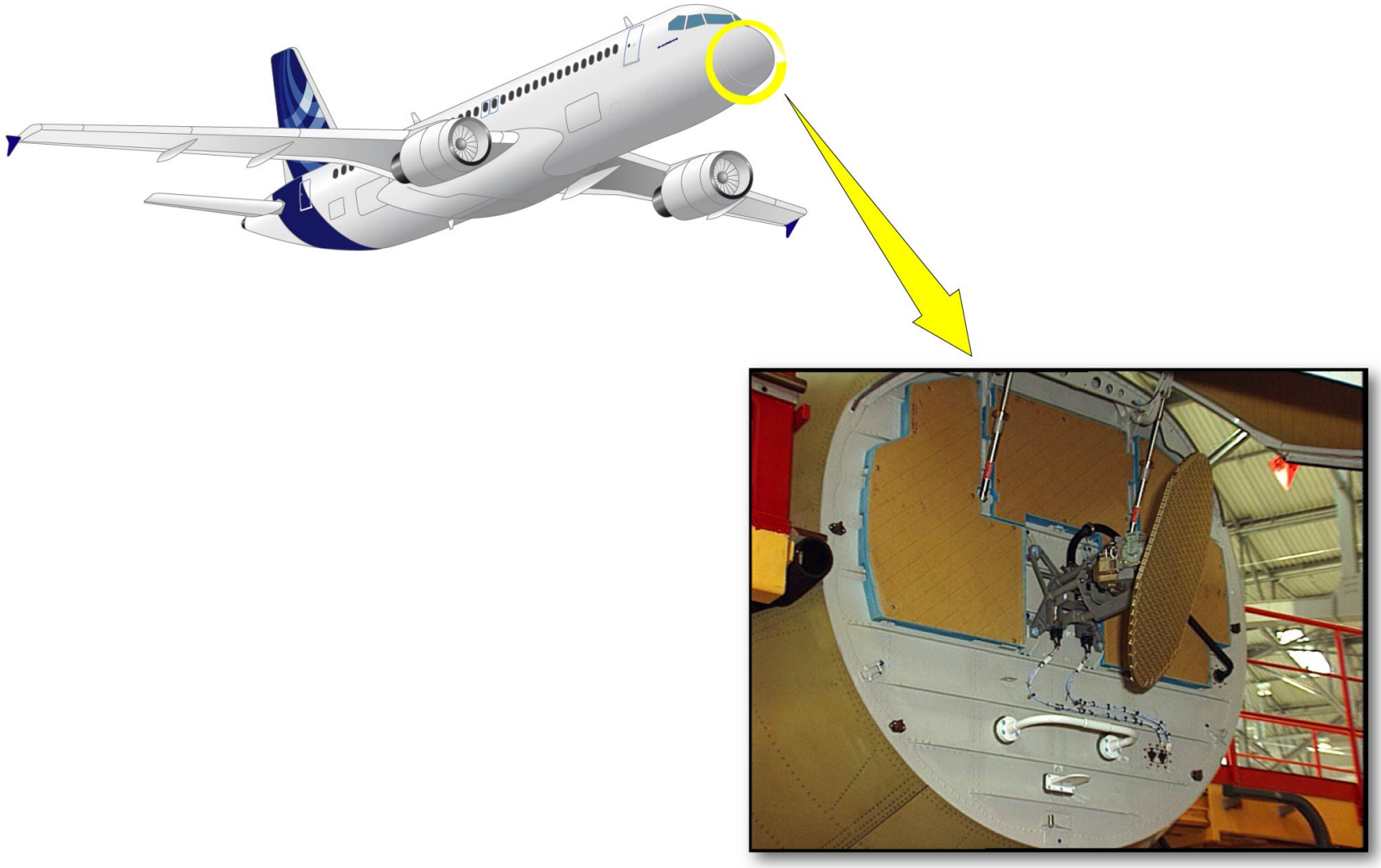
The WXR computer is in the forward avionics compartment forward of the 90VU.
The WXR antenna is installed in the radome.

UGB13131 - U7ST0M0 - UM34P600000001



Weather Radar (WXR) 1, 2

COMPONENT LOCATION



COMPONENT LOCATION

This Page Intentionally Left Blank

UGB13131 - U7ST0M0 - UM34P600000001

WXR/PWS DESCRIPTION/OPERATION (3)

GENERAL (SINGLE INSTALLATION)

The Weather Radar (WXR) and Predictive WindShear (PWS) System is composed of:
- 1 control panel,
- 1 WXR transceiver (XCVR),
- 1 antenna assembly,
- 1 wave-guide.

NOTE: The PWS installation is optional.

SYSTEM DESCRIPTION

CONTROL UNIT

The control unit gives the modes of operation, antenna tilt and gain of the receiver digitized information, via an ARINC 429 bus. An ON/OFF discrete fulfils the energization of the transceiver, which in turn supplies the control unit and the antenna assembly.

WXR XCVR

The WXR XCVR uses the principle of radio echoing to detect the level of precipitation, the ground map, and the principle of Doppler effect to detect the turbulence areas. The transceiver operates in X-Band frequency at 9345 MHz. It digitizes the video signals on two ARINC 453 data buses connected to the Display Management Computers (DMCs) for display on the NDs. The PWS function also uses the principle of Doppler effect to detect windshear events. Horizontal and vertical wind velocity and aircraft true airspeed are the different windshear components for the determination of the windshear threshold.

ANTENNA ASSEMBLY

The WXR antenna is energized and controlled in azimuth and elevation by the WXR XCVR. The radio frequency signals are exchanged between the transceiver and the antenna, via a wave-guide. The antenna scans a 180° sector in azimuth and has a tilt coverage of + or - 15°. An internal circuit of the transceiver fulfils the antenna stabilization. The stabilization data is: Pitch and roll angles, selected tilt, antenna azimuth and elevation angle.

SYSTEM INTERFACES

ADIRU

The WXR receives, from Air Data/Inertial Reference Units (ADIRUs) 1or 3, pitch and roll data, for the stabilization and control of the antenna, and ground speed for Doppler mode correction. The ADIRU, which provides data, is selected by means of the ATTittude/HeaDinG selector switch. The PWS function receives data from ADIRU 1or 3 for velocity calculations:
- true airspeed,
- altitude (or corrected altitude),
- east/west and north/south velocity ground speeds,
- track angle,
- true heading,
- and magnetic heading.

LGCIU

The Landing Gear Control Interface Unit (LGCIU) sends ground/flight and landing gear extended information to the transceiver. This discrete signal is used by the receiver BITE module to count the flight legs. The landing gear extended signal is used to determine if the A/C is taking-off or landing to generate the aural warning message:
- GO AROUND, WINDSHEAR AHEAD in approach,
- Or WINDSHEAR AHEAD, WINDSHEAR AHEAD at take-off.

CFDIU

The MCDUs let the system be tested via the Centralized Fault Display Interface Unit (CFDIU). The test is only available on ground. During

the test, the antenna carries out an elevation and an azimuth scanning sequence.

QUALIFIERS A AND B SIGNALS (IF PWS INSTALLED)

Two types of qualifier inputs are required to enable automatic activation of the windshear function.
- Qualifier type A: 2 qualifiers are used (QA1 and QA2). Provided by the Air Traffic Control (ATC)/Traffic Collision Avoidance System (TCAS) control unit, which indicates the position of the AUTO/ON/STBY switch. Qualifier A is valid when AUTO or ON is selected.
- Qualifier type B: 2 qualifiers are used (QB1 and QB2). Provided by the Engine Interface Unit (EIU) 1 and 2, which indicate a normal engine oil pressure. Qualifier B is valid when the engine is running (high oil pressure).

The windshear function is automatically activated below 2300 ft RA and one of each qualifier A and one of each qualifier B have to be valid.

RA (IF PWS INSTALLED)

The RA gives the altitude information through an ARINC 429 bus. This data is used for automatic activation, together with the two (A & B) qualifiers, of the windshear function.

AUDIO INHIBIT SIGNALS (IF PWS INSTALLED)

These discretes are used to indicate whether the aural alert output has to be active or not.
- PWS aural alerts (discrete input) are inhibited by the reactive windshear and stall warning from the Flight Warning Computers (FWCs),
- PWS discrete output is used to inhibit aural alerts generated by TCAS or Enhanced Ground Proximity Warning System (EGPWS) or other FWC warnings.

NOTE: As an option of weather radar, the auto-tilt function allows optimization of the weather detection to minimize ground clutter, and optimization of data correlation with radars returns to maximize ground clutter contrast.

AUDIO MIXING BOX (IF PWS INSTALLED)

An analog audio output transmits the aural alert windshear to an audio mixing box connected to loudspeakers.

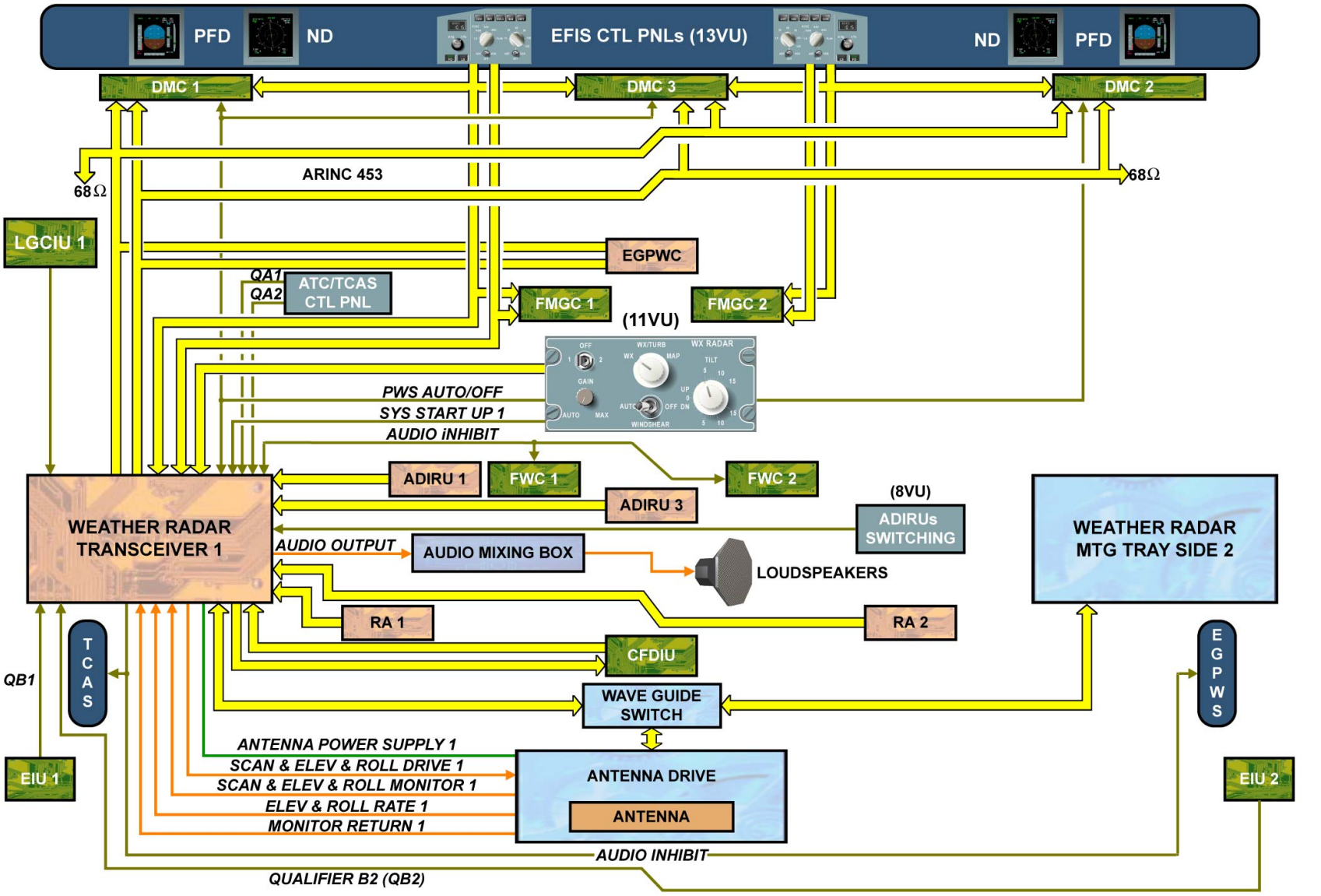
EGPWS

The EGPWS receives PWS alerts from the radar hazard bus to determine the priorities. Alert priorities are:
- WXR/PWS warning,
- WXR/PWS caution,
- Ground Proximity Warning System (GPWS) terrain warning,
- GPWS terrain caution.

INDICATING

The WXR XCVR is connected to the DMCs by means of two ARINC 453 buses. Each data bus wiring is terminated at one end by a low inductance resistor (68 ohms) to avoid a signal return. The WXR image is shown on the CAPT and F/O NDs when ROSE or ARC mode is selected on the EFIS control panel. The windshear events are shown on the CAPT and F/O NDs and all visual alerts on the CAPT and F/O PFDs for caution or warning alert (Advisory is only shown on NDs).

NOTE: When both EFIS control panels are in PLAN mode, the WXR/PWS transceiver is de-energized.



GENERAL (SINGLE INSTALLATION) ... INDICATING

This Page Intentionally Left Blank

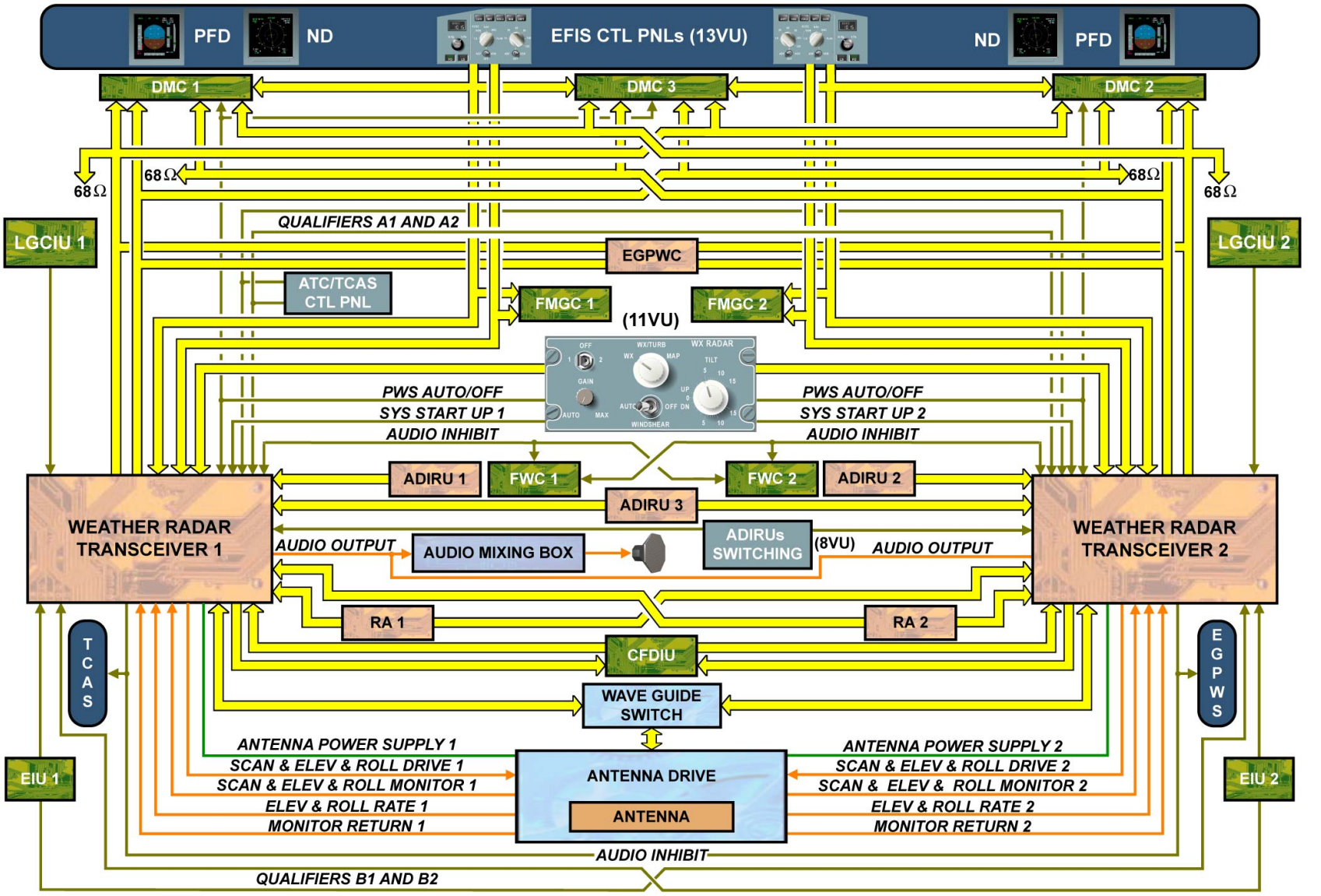
UGB13131 - U7ST0M0 - UM34DA000000001

WXR/PWS DESCRIPTION/OPERATION (3)

WXR/PWS DUAL INSTALLATION (OPTION)

Optionally the WXR/PWS system is installed in its dual configuration.
It is composed of:
- 1 control panel,
- 2 WXR XCVRs,
- 1 antenna assembly,
- 1 wave-guide,
- 1 wave-guide switch.

UGB13131 - U7ST0M0 - UM34DA000000001



WXR/PWS DUAL INSTALLATION (OPTION)

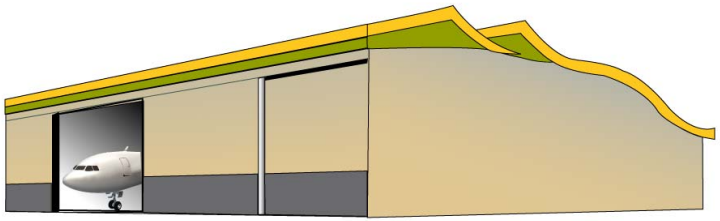
WXR/PWS OPERATIONAL PRECAUTIONS (2)

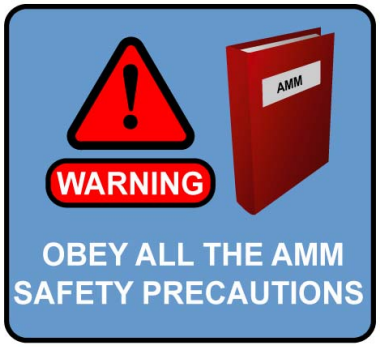
SPECIAL PRECAUTIONS

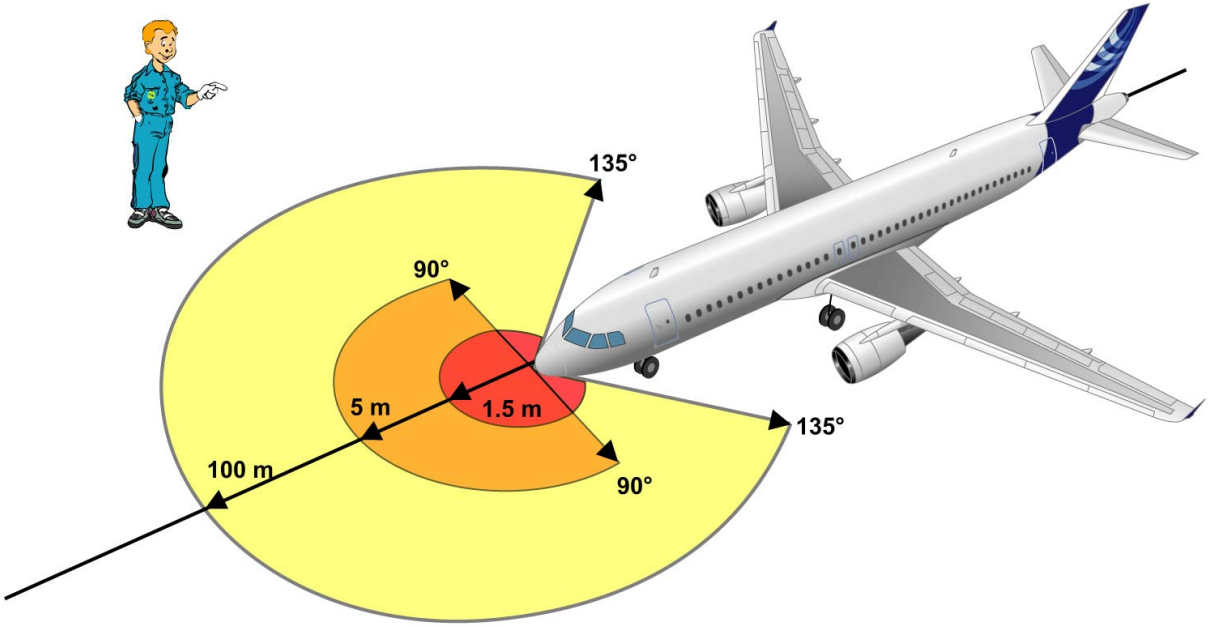
Some special precautions must be taken before using the Weather Radar (WXR) system on ground in MAP, WX or WINDSHEAR mode.
- the dangerous zone forward of the aircraft must be free of metallic obstacles such as hangars or aircraft, within 5 m in an arc of + or - 90º on either side of the aircraft centerline,
- make sure that nobody is within a distance of 1.5 m from the antenna, in an arc of + or - 135º on either side of the aircraft centerline,
- the system must not be operated during the refueling of the aircraft or during any refueling operation within 100 m.

Note: Although the power radiated by the system is low, the above written safety precautions should be observed for obvious routine reasons (behavior with respect to other types of radar systems). To avoid radiating danger, and nuisance aural alerts the WINDSHEAR AUTO/OFF selector switch must be selected OFF independently of the radar selector switch.

UGB13131 - U7ST0M0 - UM34DB000000001







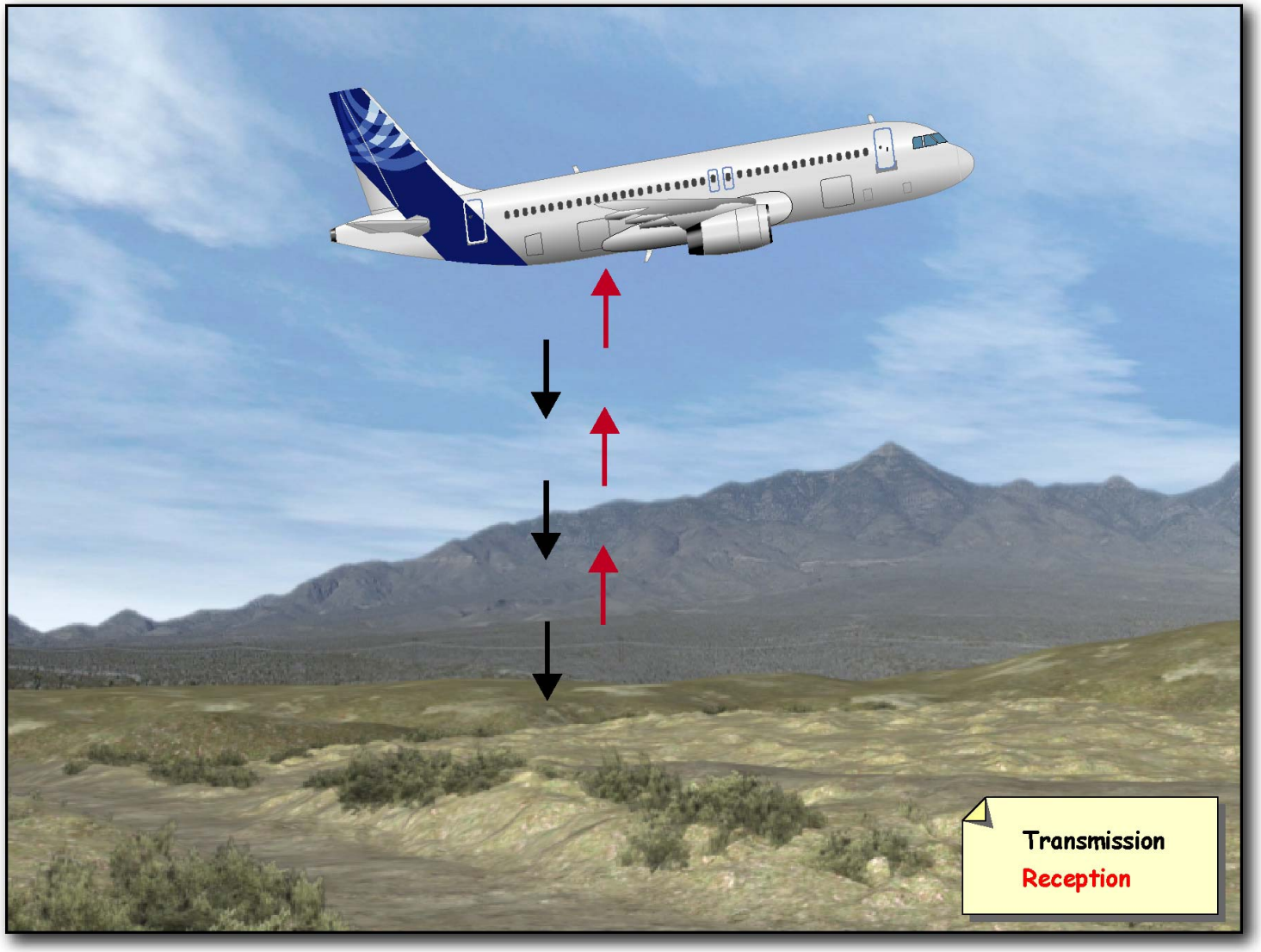
SPECIAL PRECAUTIONS

RADIO ALTIMETER SYSTEM PRESENTATION (2)

PRINCIPLE

The Radio Altimeter (RA) system calculates the height of the aircraft above the terrain during initial climb, approach and landing phases. The RA can therefore operate over non-flat ground surface. The principle of the RA is to transmit a frequency-modulated signal, from the aircraft to the ground, and to receive the ground reflected signal after a certain delay. The time between the transmission and the reception of the RA signal is proportional to the A/C height.

UGB13131 - U7ST0M0 - UM34P7000000001



PRINCIPLE

RADIO ALTIMETER SYSTEM PRESENTATION (2)

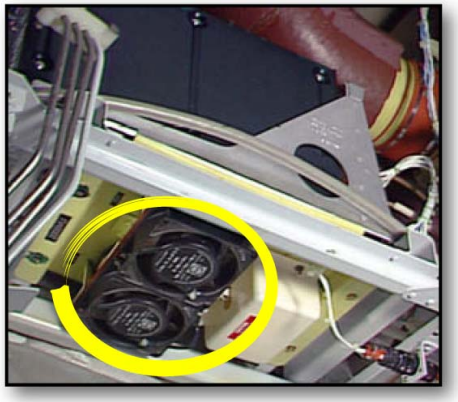
COMPONENTS

The components are two transceivers, two fans, two transmission antennas and two reception antennas. The RA system is also connected to the DMCs for display on the PFDs.

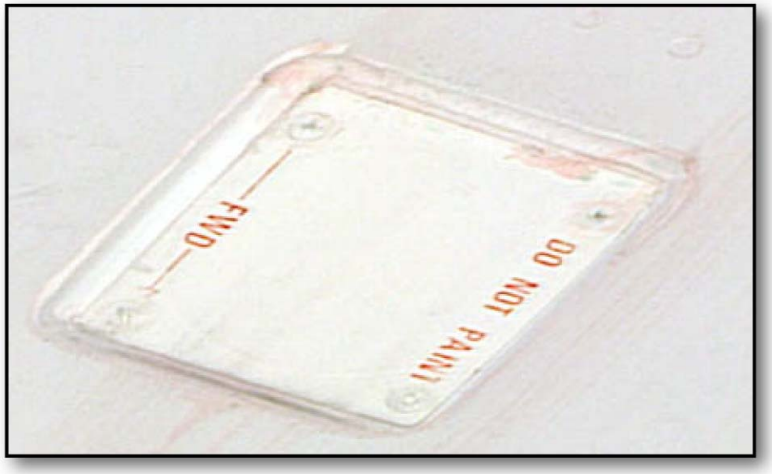
UGB13131 - U7ST0M0 - UM34P7000000001

RADIO ALTIMETER TRANSCEIVERS

FANS



RADIO ALTIMETER ANTENNA



T: TRANSMISSION ANTENNA
R: RECEPTION ANTENNA

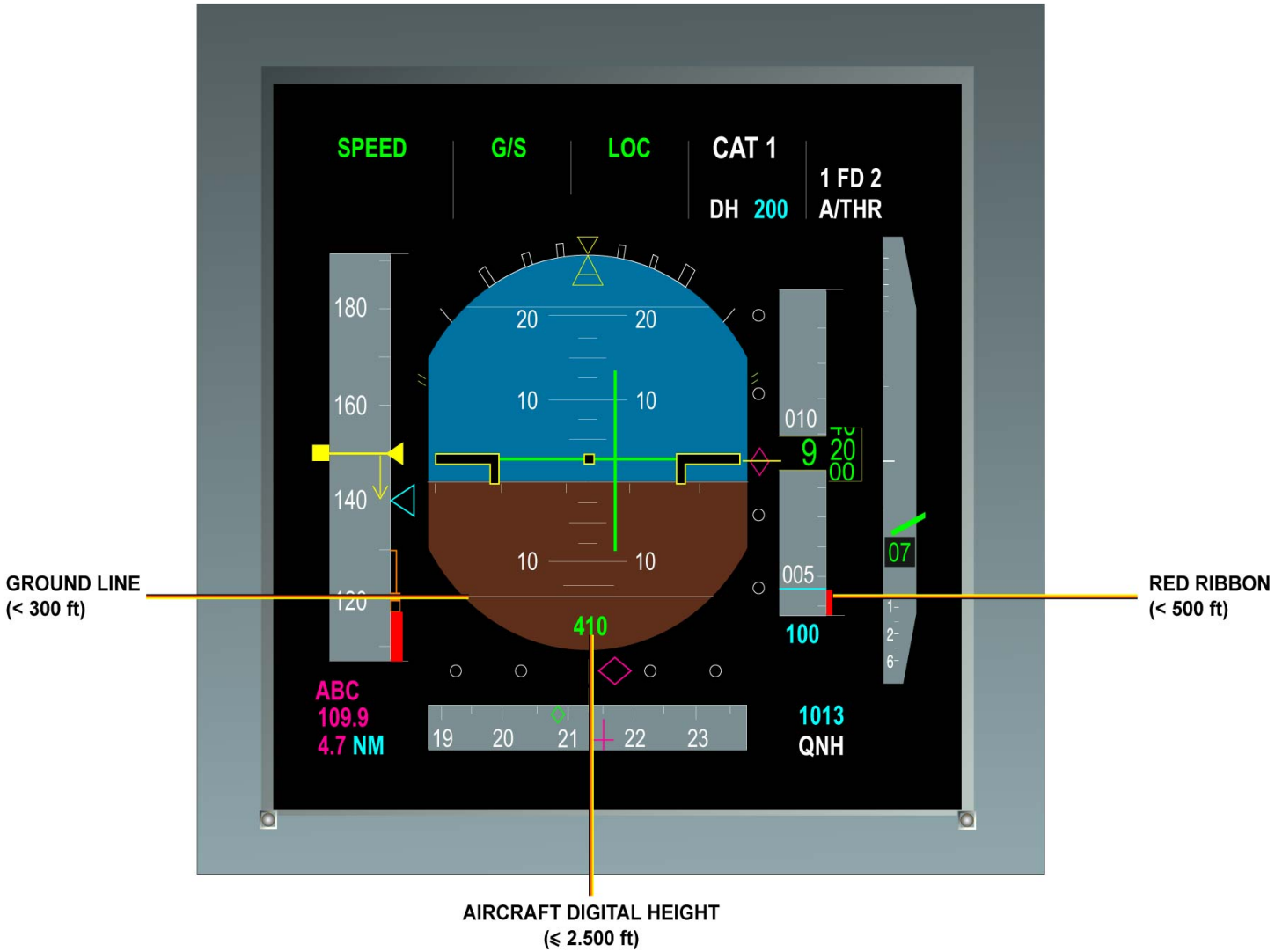
COMPONENTS

RADIO ALTIMETER SYSTEM PRESENTATION (2)

INDICATING

The A/C height data is displayed on the PFDs for heights less than or equal to 2.500 ft. The altitude is also shown by means of:
- a red ribbon next to the altitude scale (below 500 ft),
- a ground line rising on to the pitch down area (below 300 ft).

UGB13131 - U7ST0M0 - UM34P7000000001


SPEED
G/S
LOC
CAT 1
1 FD 2
A/THR
DH 200
180
160
140
120
20
20
10
10
10
10
010
9
20
00
005
100
07
410
ABC
109.9
4.7 NM
19
20
21
22
23
1013
QNH
GROUND LINE
(< 300 ft)
RED RIBBON
(< 500 ft)
AIRCRAFT DIGITAL HEIGHT
(≤ 2.500 ft)

INDICATING

RADIO ALTIMETER SYSTEM PRESENTATION (2)

COMPONENT LOCATION

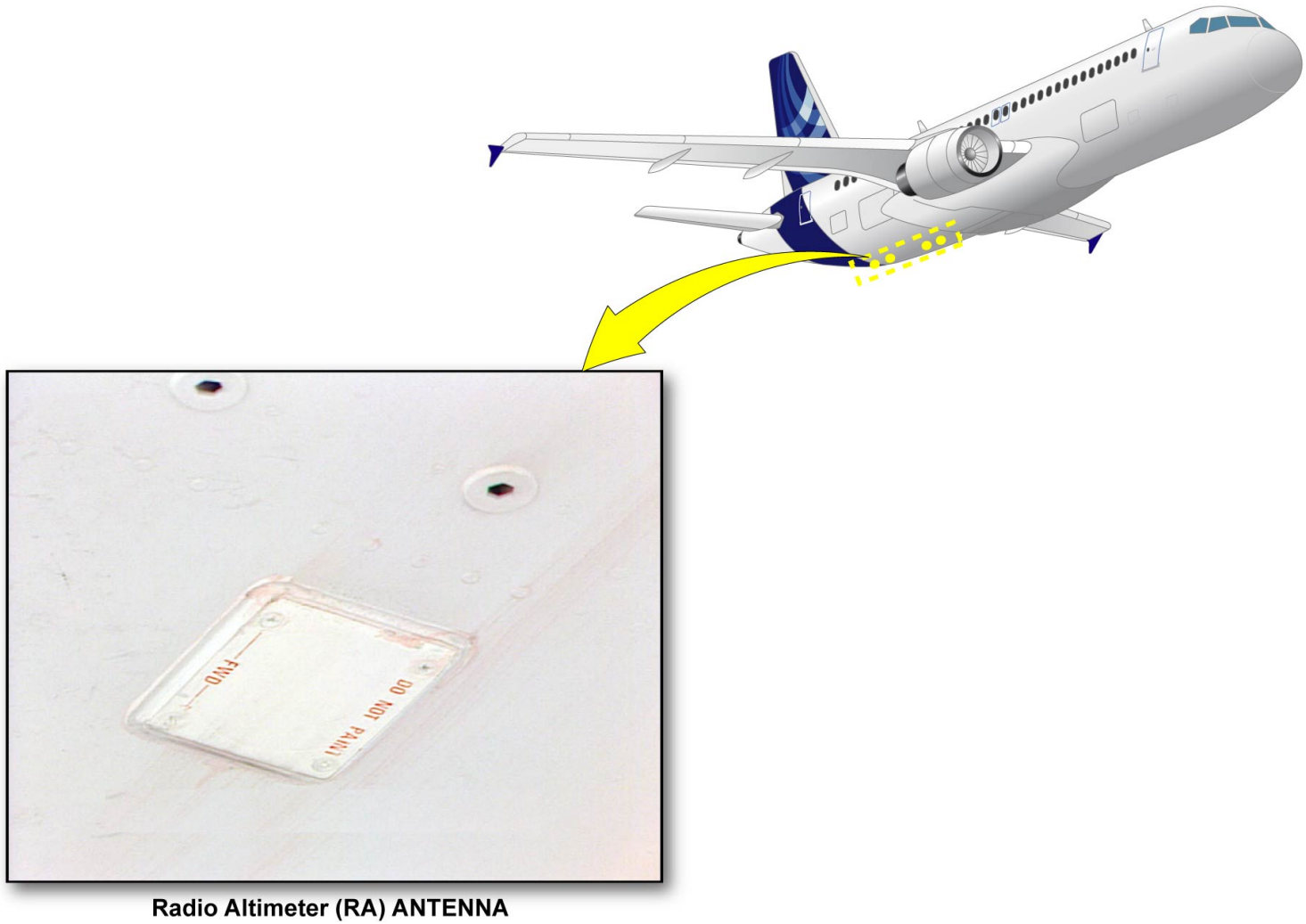
The RAs are installed in the aft cargo compartment.
The RA antennas are installed on the lower portion of the fuselage aft of the main landing gear.

UGB13131 - U7ST0M0 - UM34P7000000001

AFT CARGO COMPARTMENT

Radio Altimeter (RA) 1, 2

COMPONENT LOCATION



Radio Altimeter (RA) ANTENNA

COMPONENT LOCATION

This Page Intentionally Left Blank

UGB13131 - U7ST0M0 - UM34P7000000001

RADIO ALTIMETER DESCRIPTION/OPERATION (3)

GENERAL

The RA system is made of two independent systems and has:
- two transceivers with associated mounts and fans,
- two transmission antennas,
- two reception antennas.

TRANSCEIVER

The RA transceiver measures the radio height of the aircraft in relation to the ground. The transceiver operates in a frequency range of 4.200 to 4.400 MHz.

ANTENNA

The RA system includes two identical transmission and reception antennas. The operating range of the antenna according to the aircraft attitude is limited to + or - 30° for pitch and roll.

FAN

Each RA transceiver is cooled by an associated fan, attached under the transceiver mount. A capacitor is mounted on the fan case in order to suppress the parasites.

INDICATING

In normal operation, RA 1 provides the radio height to the CAPT PFD and RA 2 to the F/O PFD through the Display Management Computers (DMCs). In case of one transceiver failure the DMC automatically switches to the other one. The radio height information appears on the PFDs when less than or equal to 2.500 ft.

USERS

The RA information is sent to various systems through ARINC 429 buses. The system users are:
- Enhanced Ground Proximity Warning System (EGPWS) for terrain warnings,
- Flight Management and Guidance Computers (FMGCs) for processing data,
- Flight Warning Computers (FWCs) for call out indications and warnings,
- ELevator Aileron Computers (ELACs) for integration into various flight parameters.

EIU

The Engine Interface Unit (EIU) 1(2) sends a ground discrete to the RA 1(2) to inhibit the test on ground when the associated engine N2 rating (high-pressure compressor rotational speed) is greater than minimum idle rating.

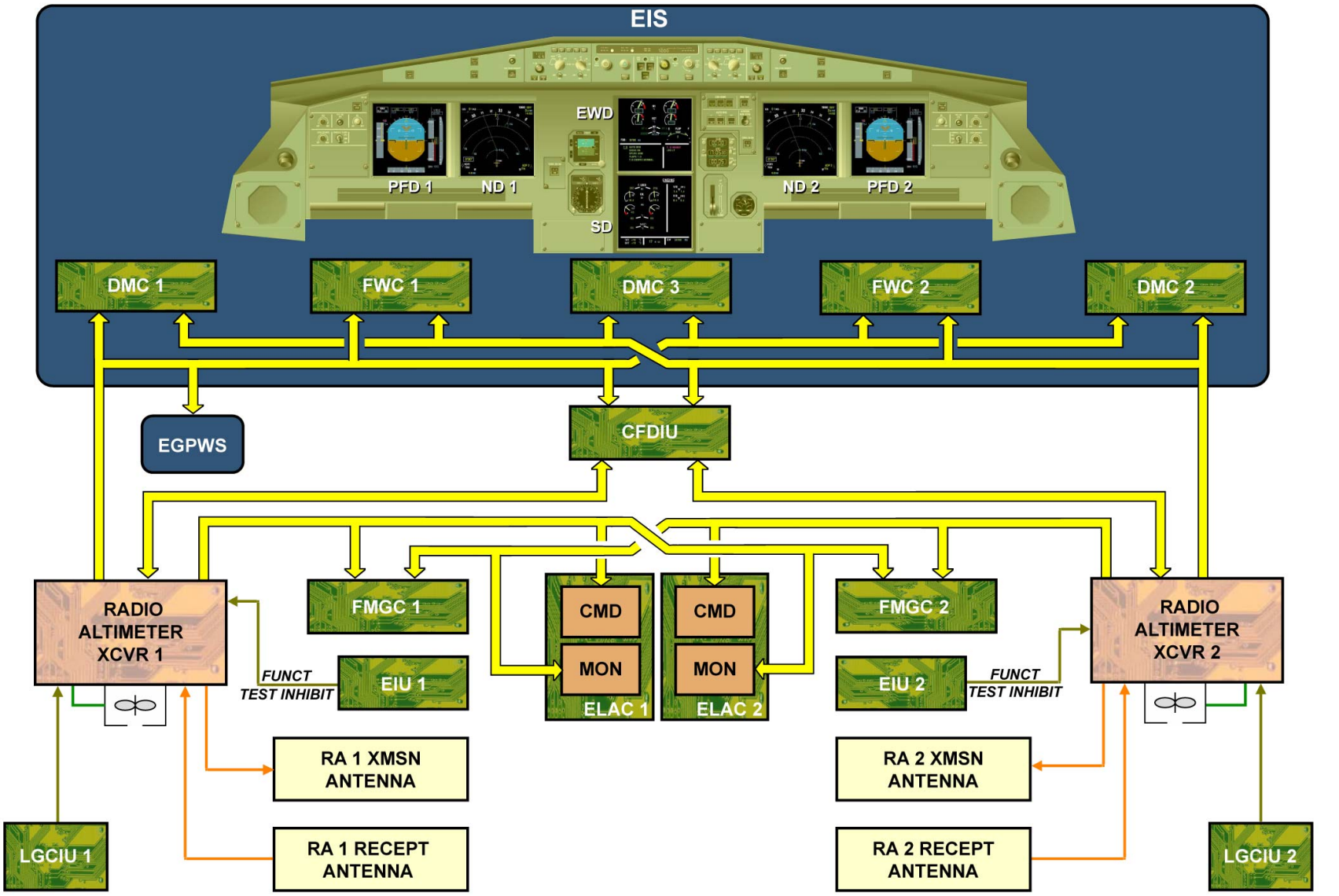
LGCIU

The Landing Gear Control and Interface Unit (LGCIU) provides the flight/ground information, which is used by the transceiver BITE module to count the flight legs.

CFDIU

The MCDUs allow the systems to be tested via the Centralized Fault Display Interface Unit (CFDIU). The tests are only available on ground.

UGB13131 - U7ST0M0 - UM34DC000000001



GENERAL ... CFDIU

TCAS PRESENTATION (2)

PRINCIPLE

The Traffic and Collision Avoidance System (TCAS) is a system whose function is to detect and display aircrafts in the immediate vicinity and to provide the flight crew with indications to avoid these intruders. The Traffic and Terrain Collision Avoidance System (T2CAS) is an optional system, which ensures the same functions as the TCAS.

NOTE: The TCAS II provides indications to avoid these intruders by changing the flight path in the vertical plane only.

The TCAS detects the Air Traffic Control (ATC) system or TCAS equipped aircraft and maintains surveillance within a range determined by its sensivity. To evaluate threat potential of other aircraft the system divides the space around aircraft into 4 volumes.

OTHER TRAFFIC VOLUME

The other traffic volume is the first volume providing the presence and the progress of an intruder. The aircraft detected in this zone does not represent a collision threat.

PROXIMATE TRAFFIC VOLUME

The proximate traffic volume is defined by a given volume around the TCAS (or T2CAS) equipped aircraft. The aircraft detected in this zone does not represent a collision threat, but is declared in vicinity.

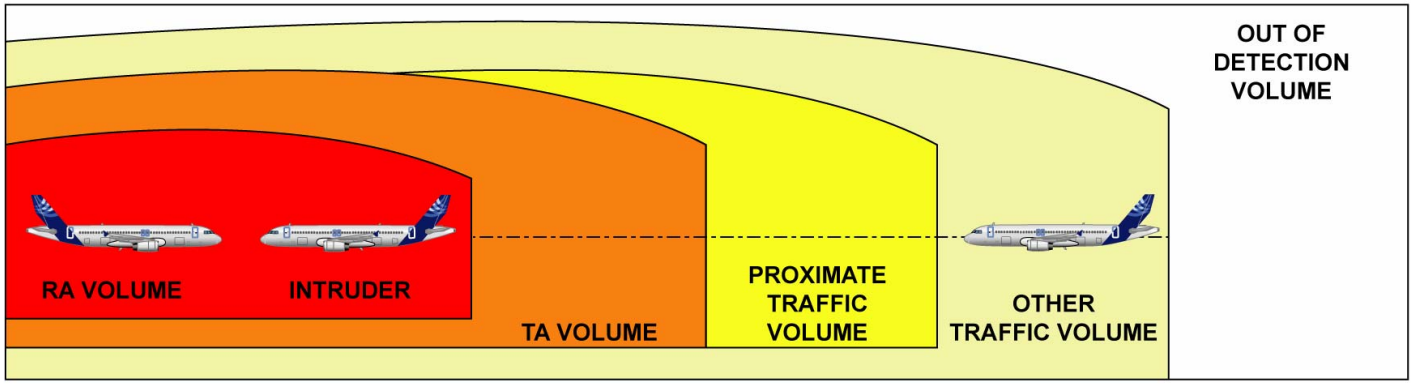
TA VOLUME

When the intruder is relatively near but does not represent an immediate threat, the TCAS (or T2CAS) provides aural and visual information known as Traffic Advisory (TA). The TCAS (or T2CAS) aural messages can be inhibited depending on higher priority aural messages.

RA VOLUME

When the intruder represents a collision threat, the TCAS (or T2CAS) triggers an aural and visual alarm known as Resolution Advisory (RA), which informs the crew about avoidance maneuvers.

UGB13131 - U7ST0M0 - UM34P800000001



INTRUDER LOCATION / INTRUDER EQUIPMENT	RESOLUTION ADVISORY (RA) VOLUME	TRAFFIC ADVISORY (TA) VOLUME	PROXIMATE TRAFFIC VOLUME	OTHER TRAFFIC VOLUME	OUT OF DETECTION VOLUME
WITHOUT OPERATIVE ATC	NO DETECTION	NO DETECTION	NO DETECTION	NO DETECTION	NO DETECTION
WITH ATC MODE A	TA WITHOUT INTRUDER RELATIVE ALTITUDE	TA WITHOUT INTRUDER RELATIVE ALTITUDE	TRAFFIC INFORMATION WITHOUT INTRUDER RELATIVE ALTITUDE	TRAFFIC INFORMATION WITHOUT RELATIVE ALTITUDE	
WITH ATC MODE C OR S	RA WITHOUT A/C MANEUVER COORDINATION	TA WITH INTRUDER RELATIVE ALTITUDE	TRAFFIC INFORMATION WITH INTRUDER RELATIVE ALTITUDE	TRAFFIC INFORMATION WITH INTRUDER RELATIVE ALTITUDE	
WITH TCAS II or T2CAS if installed	RA WITH A/C MANEUVER COORDINATION				

ATC: Air Traffic Control

TCAS: Traffic alert and Collision Avoidance System

T2CAS: Traffic and Terrain Collision Avoidance System

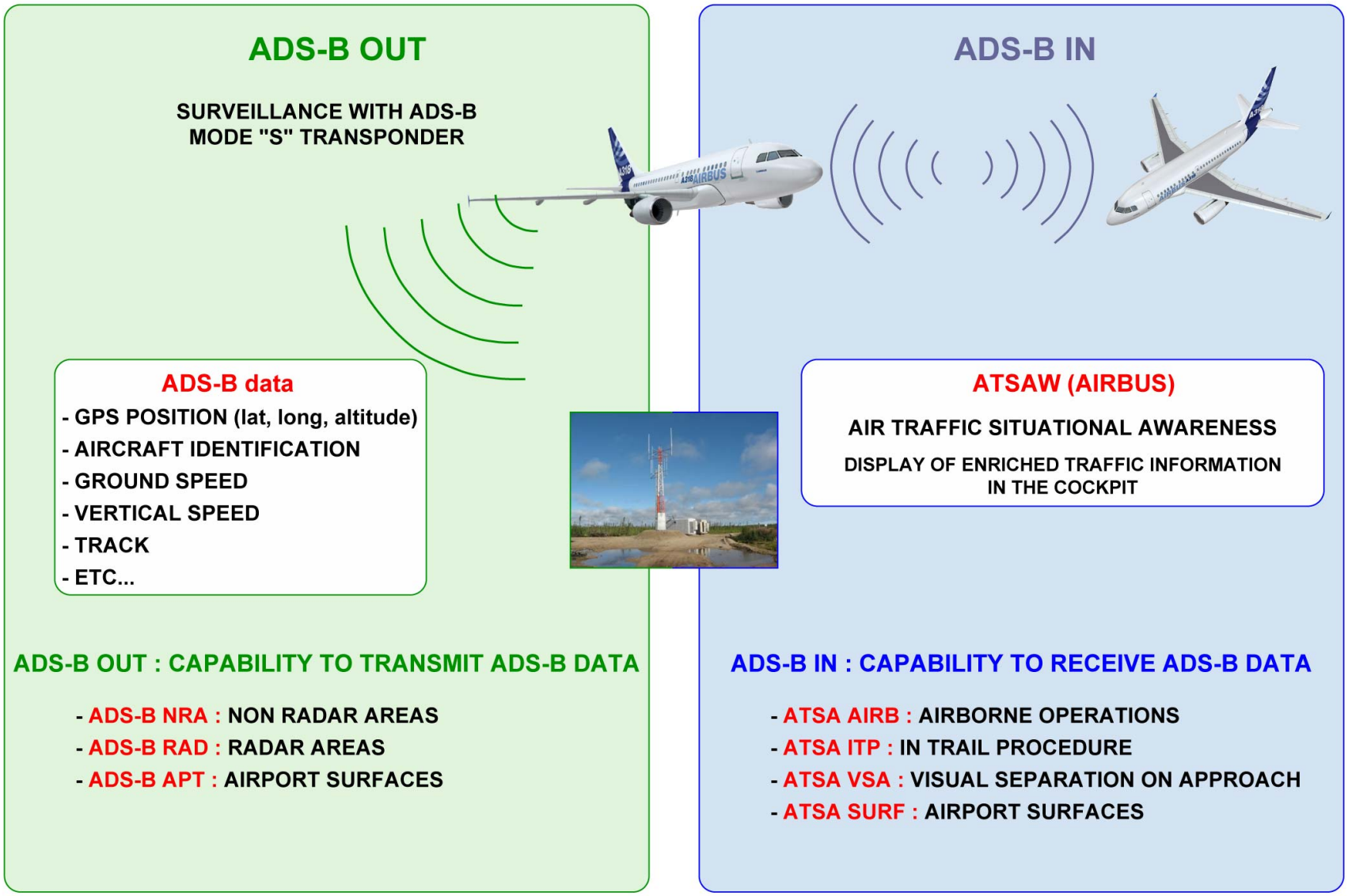
PRINCIPLE - OTHER TRAFFIC VOLUME ... RA VOLUME

TCAS PRESENTATION (2)

ADS-B APPLICATIONS (OPTION)

The TCAS can also receive and compute passive surveillance Automatic Dependent Surveillance-Broadcast (ADS-B or extended squitters) from the Enhanced Surveillance (EHS) transponders. This function is activated through pin programming.

UGB13131 - U7ST0M0 - UM34P800000001


ADS-B OUT
SURVEILLANCE WITH ADS-B
MODE "S" TRANSPONDER
ADS-B IN
ADS-B data
- GPS POSITION (lat, long, altitude)
- AIRCRAFT IDENTIFICATION
- GROUND SPEED
- VERTICAL SPEED
- TRACK
- ETC...
ATSAW (AIRBUS)
AIR TRAFFIC SITUATIONAL AWARENESS
DISPLAY OF ENRICHED TRAFFIC INFORMATION
IN THE COCKPIT
ADS-B OUT : CAPABILITY TO TRANSMIT ADS-B DATA
- ADS-B NRA : NON RADAR AREAS
- ADS-B RAD : RADAR AREAS
- ADS-B APT : AIRPORT SURFACES
ADS-B IN : CAPABILITY TO RECEIVE ADS-B DATA
- ATSA AIRB : AIRBORNE OPERATIONS
- ATSA ITP : IN TRAIL PROCEDURE
- ATSA VSA : VISUAL SEPARATION ON APPROACH
- ATSA SURF : AIRPORT SURFACES

ADS-B APPLICATIONS (OPTION)

TCAS PRESENTATION (2)

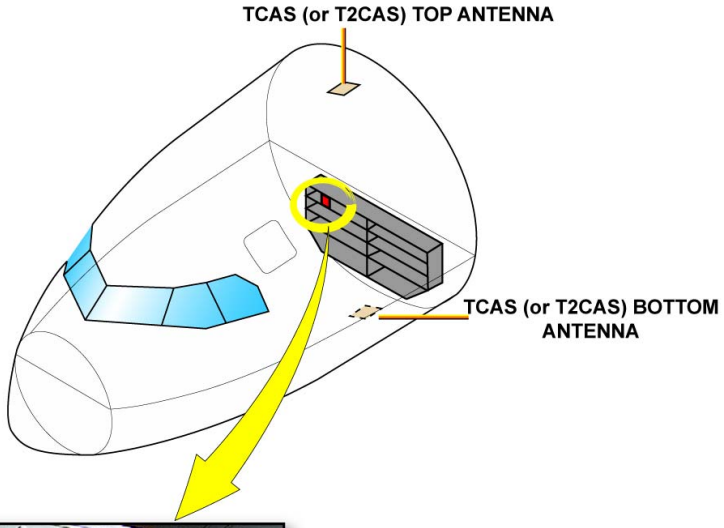
COMPONENTS

The TCAS (or T2CAS) components are two antennas, one TCAS II computer (or T2CAS computer) and one TCAS/ATC control panel.

NOTE: The TCAS/ATC control panel shown here after is given as example. It may differ according to the aircraft configuration.

UGB13131 - U7ST0M0 - UM34P800000001

(11VU)



Traffic Collision Avoidance System (TCAS)

OR

Traffic and Terrain Collision Avoidance System (T2CAS)

OPTION

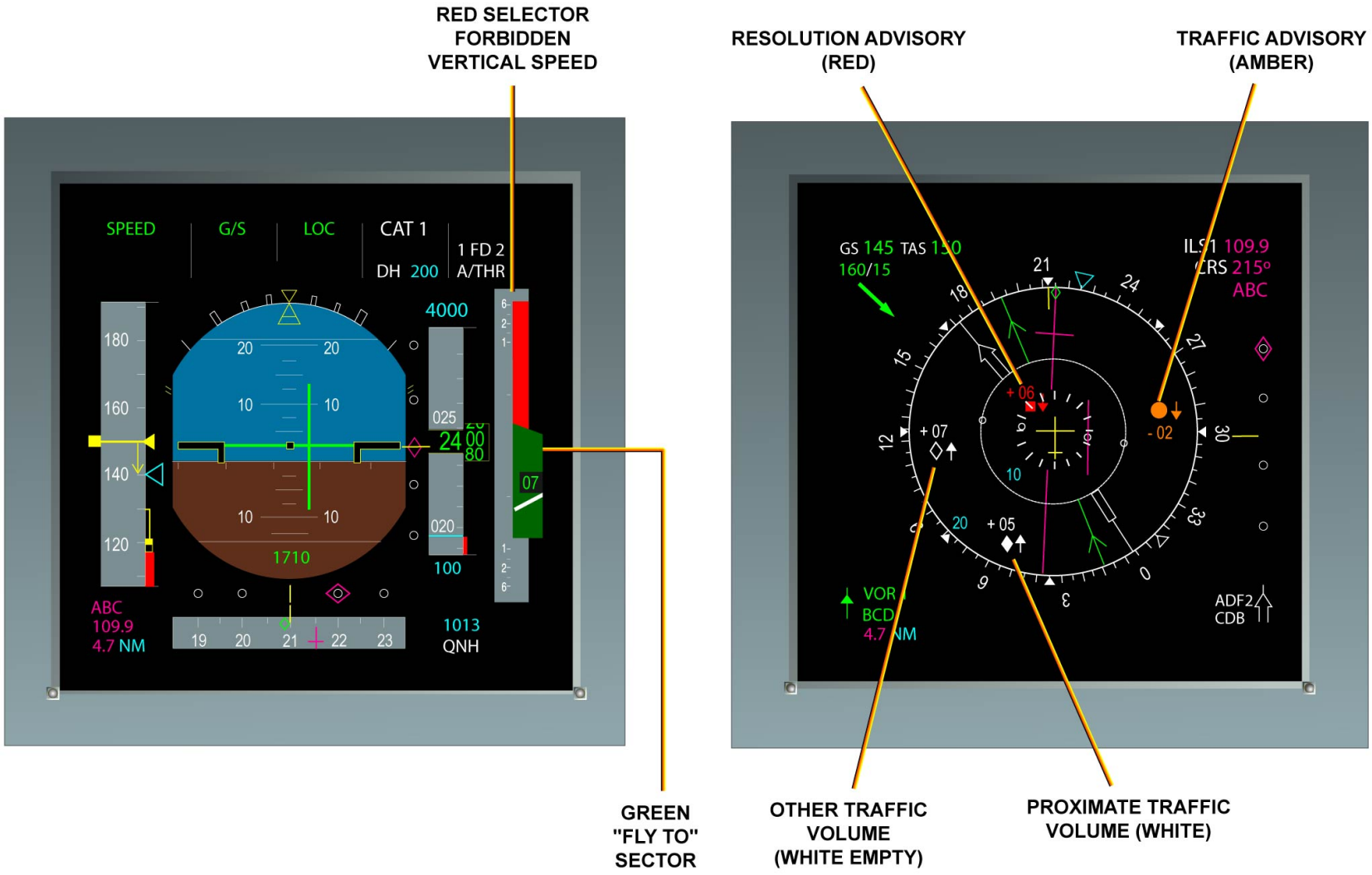
COMPONENTS

TCAS PRESENTATION (2)

INDICATING

The TCAS (or T2CAS) indications appear on the PFDs and the NDs. The visual resolution and TA indications are associated with aural indications such as "TRAFFIC, TRAFFIC", "CLIMB, CLIMB"... The TCAS displays only the most threatening intruders.

UGB13131 - U7ST0M0 - UM34P800000001



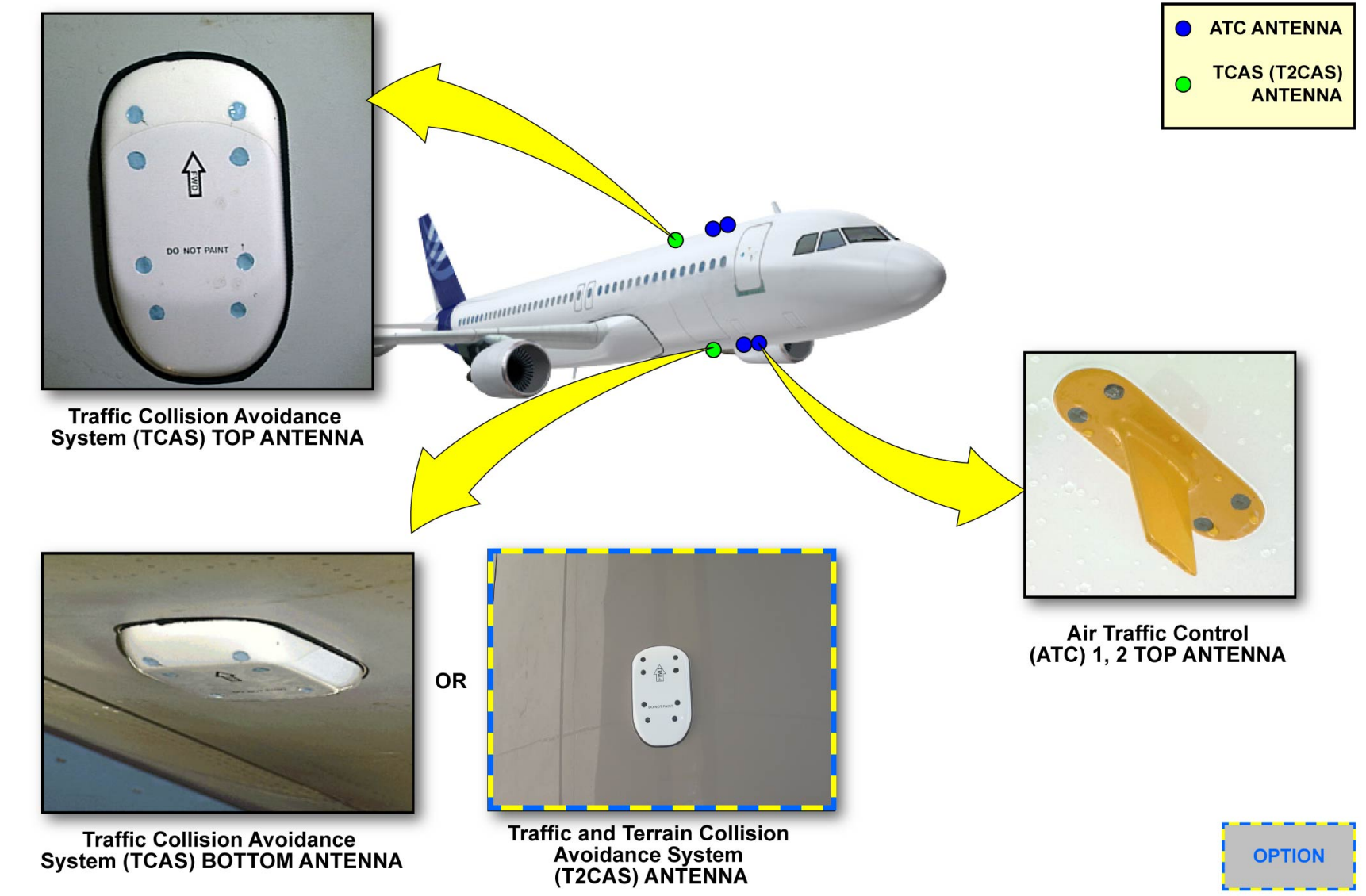
INDICATING

UGB13131 - U7ST0M0 - UM34P8000000001

TCAS PRESENTATION (2)

COMPONENT LOCATION

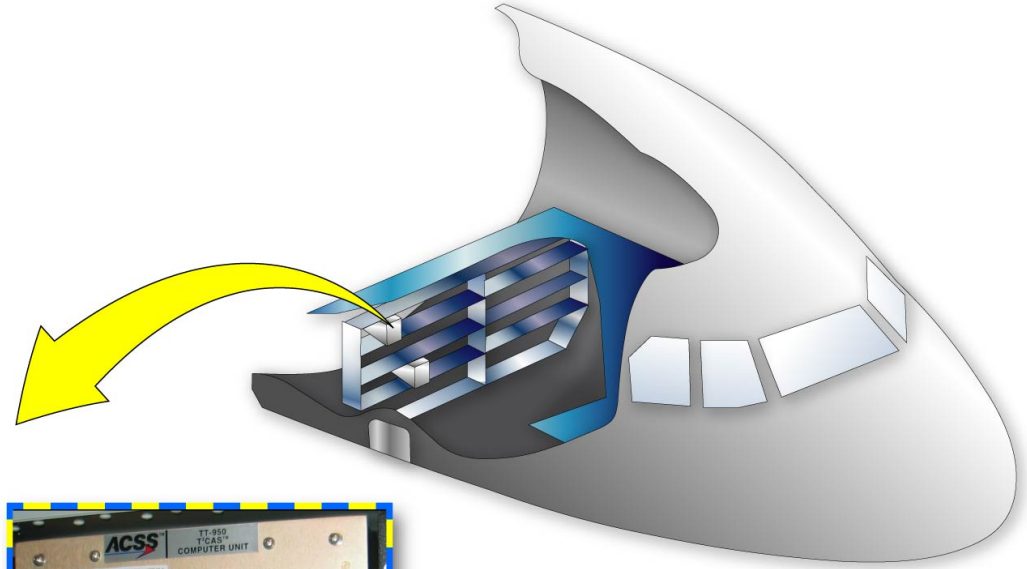
The radio navigation receiver antennae are installed on the upper and lower fuselage.
The TCAS or T2CAS computers are installed in the avionics compartment.


ATC ANTENNA
TCAS (T2CAS) ANTENNA
DO NOT PAINT
Traffic Collision Avoidance System (TCAS) TOP ANTENNA
Air Traffic Control (ATC) 1, 2 TOP ANTENNA
OR
Traffic Collision Avoidance System (TCAS) BOTTOM ANTENNA
Traffic and Terrain Collision Avoidance System (T2CAS) ANTENNA
OPTION

COMPONENT LOCATION

Traffic Collision Avoidance System (TCAS)

OR



Traffic and Terrain Collision Avoidance System (T2CAS)

OPTION

COMPONENT LOCATION

This Page Intentionally Left Blank

TCAS DESCRIPTION/OPERATION (3)

GENERAL

The Traffic alert and Collision Avoidance System (TCAS) includes:
- 1 control unit common with Air Traffic Control (ATC) system,
- 1 computer,
- 2 antennas (1 top and 1 bottom).

NOTE: As an option, the Traffic alert and Collision Avoidance System (TCAS) part of the Traffic and Terrain Collision Avoidance System (T2CAS) can replace the TCAS.

ANTENNA

The TCAS (or TCAS part of theT2CAS if installed) directional antennas provide azimuth information on aircraft located within the TCAS (or T2CAS-TCAS) surveillance range. They transmit at 1.030 MHz and receive at 1.090 MHz. The phase and amplitude of the received signal depend on the direction of the signal source, which permits the relative bearing of the transmitting aircraft to be determined.

SUPPRESSOR

The TCAS (or T2CAS-TCAS if installed), ATC, and the Distance Measurement Equipment (DME) operate in the same frequency range. A suppressor signal is transmitted, via a coaxial, by the operating system to inhibit the other systems and to prevent simultaneous transmission.

CONTROL PANEL

The operating modes of the TCAS (or T2CAS-TCAS if installed) are selected on a common ATC/TCAS control panel. The TCAS (or T2CAS-TCAS if installed) information is transmitted to the TCAS (or T2CAS) computer via the ATC transponder.

COMPUTER

The TCAS computer ensures two main functions:
- a transmission/reception function for intruder acquisition,
- a processing function for operation control: Digital, discrete and analog types interfaces, intruder trajectory computation and tracking, visual and aural alert commands.

ATC

The operative ATC mode S transponder transmits response to ATC ground station interrogations and data to the TCAS: Barometric altitude, TCAS mode from control panel, TCAS broadcast messages. The Mode S transponder permits communication between the TCAS and a TCAS equipped and detected aircraft through the communication link function for exchanging coordination messages.

RADIO ALTIMETER

The RA transceivers provide radio height used as reference to determine the computation sensitivity level and trigger the inhibit orders. The radio height is used in the 0 to 2.500 ft range.

ADIRU

The Inertial Reference (IR) part of the Air Data/Inertial Reference Unit (ADIRU) provides the magnetic heading and the pitch and roll attitude information to the TCAS (or T2CAS) computer.

NOTE: The barometric altitude is transmitted via the ATC transponder.

UGB13131 - U7ST0M0 - UM34DD000000001

CFDIU

The Centralized Fault Display Interface Unit (CFDIU) allows testing and trouble-shooting of the TCAS (or T2CAS if installed) through the MCDU. The tests are only available on ground.

LGCIU

The Landing Gear Control and Interface Unit (LGCIU) provides a flight/ground signal used by the BITE module for flight leg counting. It provides also a landing gear extended signal for TCAS (or T2CAS) operation.

INDICATING

Visual indications are presented on the NDs and PFDs. The NDs present the location of intruders in the traffic area. The PFDs present the avoidance maneuver indications on the vertical speed scale. The Flight Warning Computers (FWCs) monitor the validity of the information. Synthesized voice announcements generated by the TCAS (or T2CAS) computer and broadcast by the loudspeakers accompany the visual indications.

INHIBITION

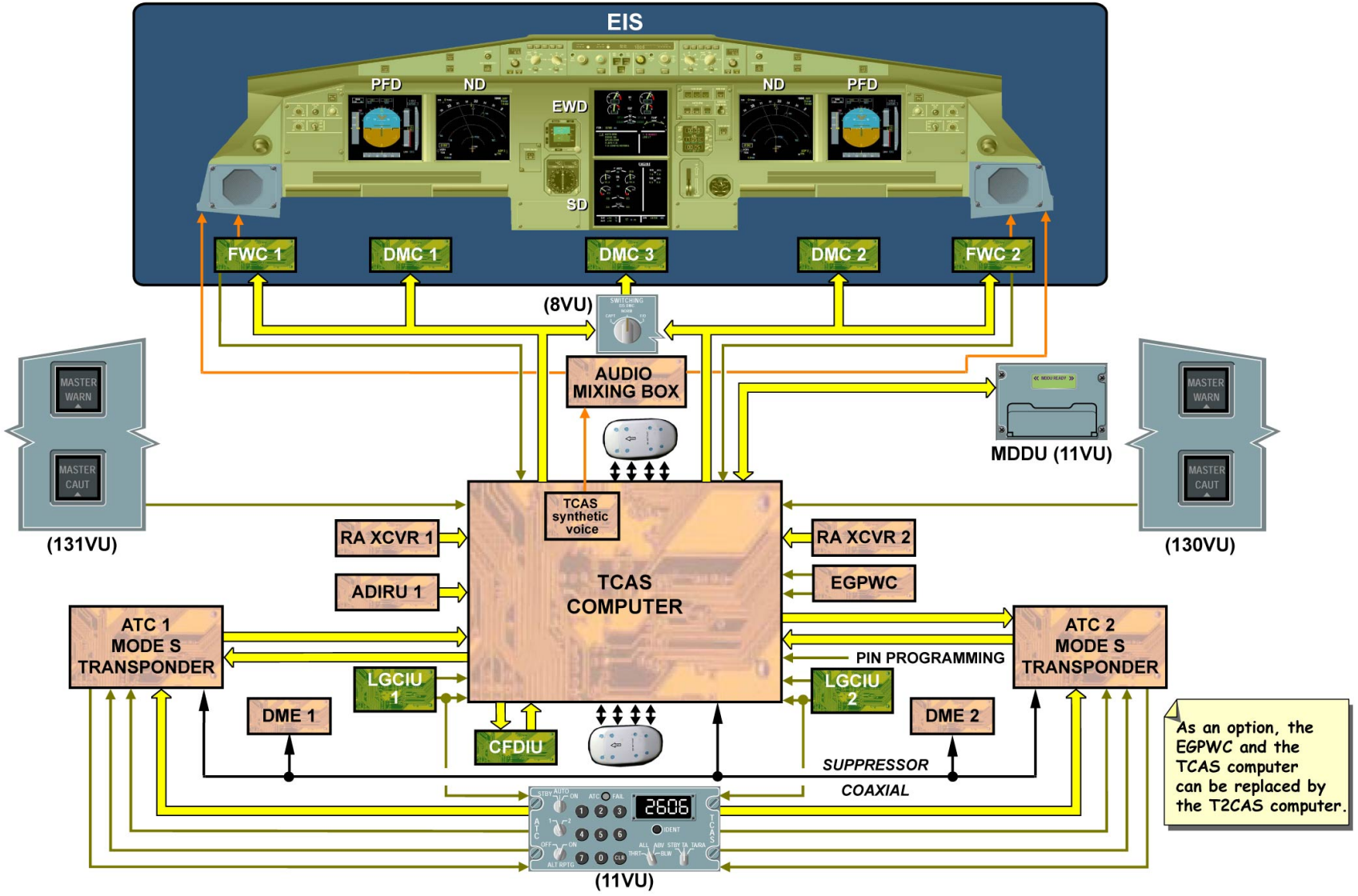
Various discrete signals are used for inhibition by equipment with higher priority than the TCAS (or T2CAS). These priorities are:
- Stall,
- WindShear,
- Predictive WindShear (PWS),
- Enhanced Ground Proximity Warning System (EGPWS) messages.

PIN PROGRAMMING

Some pin programs define the operating mode of the TCAS (or T2CAS).
Operating mode:
- audio level output,
- all traffic/threat traffic display,
- ground display mode (TA mode),
- number of intruders displayed (8 maximum),
- aircraft altitude limit (48.000 ft).

DATA LOADER

It will be possible to load software data into the TCAS (or T2CAS) computer by means of a data loader. The remote loading capability is linked by 2 ARINC 429 low speed buses to a dedicated connector in the aircraft.



GENERAL ... DATA LOADER

This Page Intentionally Left Blank

UGB13131 - U7ST0M0 - UM34DD000000001

EGPWS PRESENTATION (2)

GENERAL

The Enhanced Ground Proximity Warning System (EGPWS) is built over the current Ground Proximity Warning System (GPWS). EGPWS = GPWS + "ENHANCED" functions.
As an option, the Traffic and Terrain Collision Avoidance System (T2CAS) can be installed instead of the EGPWS. The T2CAS includes partitioned modular functions for both Traffic Collision Avoidance System (TCAS) and Terrain Awareness and Warning System (TAWS) functions. The TAWS part of T2CAS carries out the same functions as the EGPWS.

PRINCIPLE

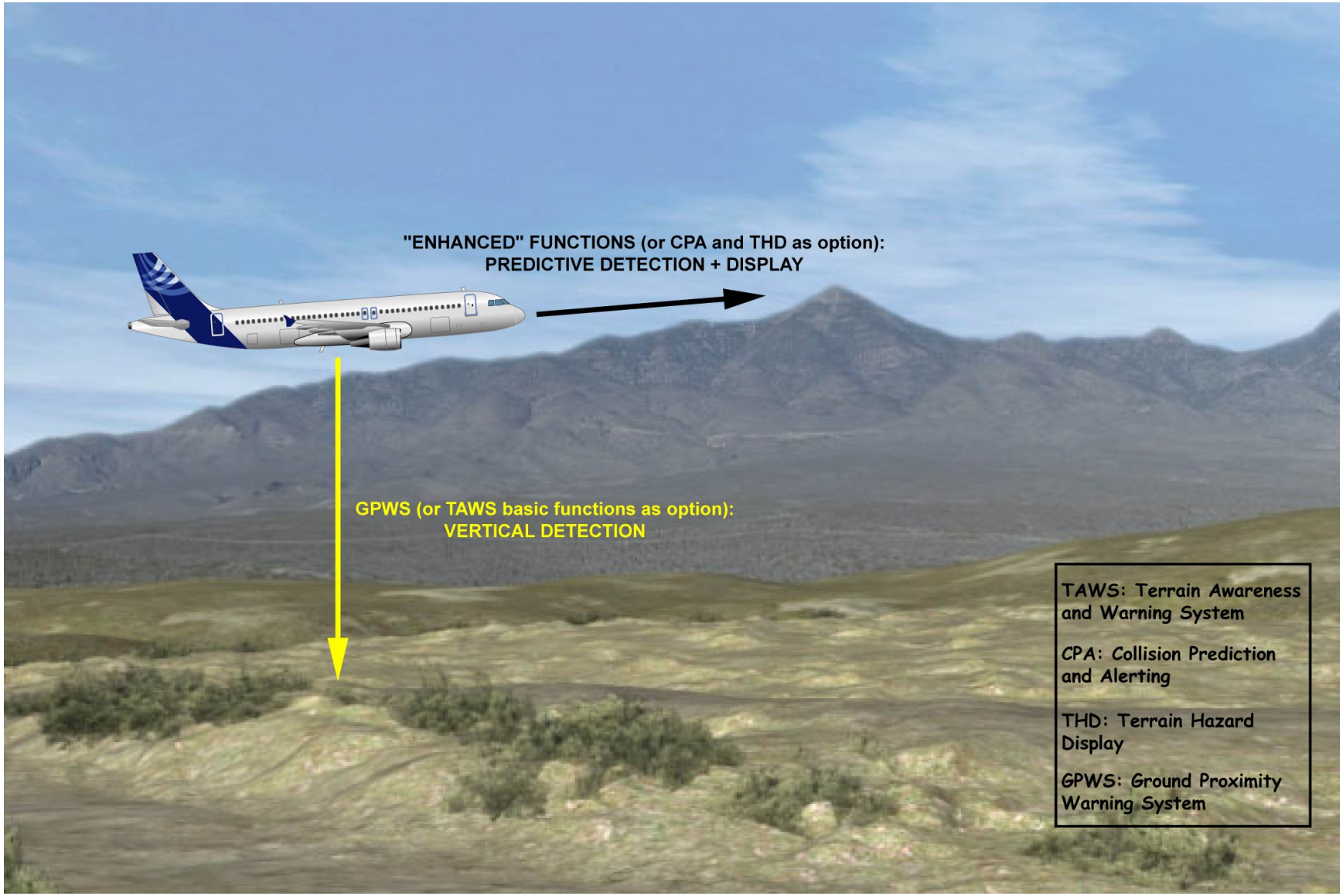
The purpose of the EGPWS is to help prevent accidents caused by Controlled Flight Into Terrain (CFIT). When the limits of an alerting envelope are exceeded, aural alert messages, visual annunciations and displays are generated. The basic GPWS modes generate aural and visual warnings that correspond to an aircraft behavior when the alert envelope is penetrated. The "ENHANCED" functions added to the basic GPWS modes are:
- Terrain Clearance Floor (TCF): Increases the terrain clearance envelope around the airport runway.

NOTE: With the optional geometric altitude function, the EGPWS can operate reliably in extreme local pressure or temperature variations from standard.

- Terrain Awareness alerting and Display (TAD): Includes a terrain database to predict conflict between flight path and terrain and to display the conflicting terrain.

NOTE: The EGPWS can also include an obstacle database in which are recorded the man-made obstacles. They are treated as terrain.

The alerting functions integrated in the T2CAS-TAWS part are:
- basic GPWS functions (Modes 1 to 5), mainly based on Radio Altitude,
- predictive modes: Collision Prediction and Alerting (CPA) function and Terrain Hazard Display (THD) function, which gives forward-looking terrain avoidance and premature descent alert functions.


"ENHANCED" FUNCTIONS (or CPA and THD as option):
PREDICTIVE DETECTION + DISPLAY
GPWS (or TAWS basic functions as option):
VERTICAL DETECTION
TAWS: Terrain Awareness and Warning System
CPA: Collision Prediction and Alerting
THD: Terrain Hazard Display
GPWS: Ground Proximity Warning System

GENERAL & PRINCIPLE

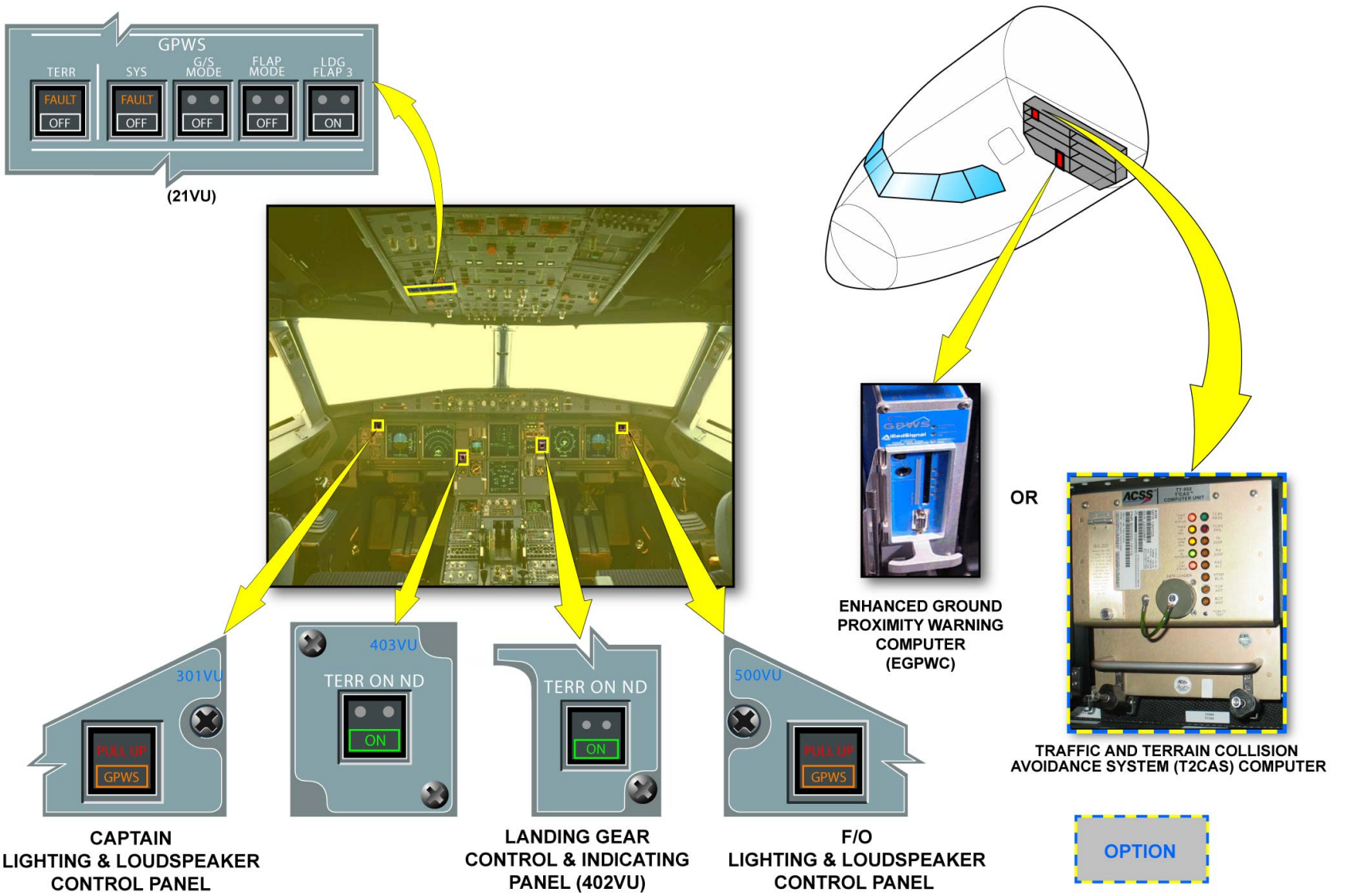
EGPWS PRESENTATION (2)

COMPONENTS

The system comprises an Enhanced Ground Proximity Warning Computer (EGPWC) (or T2CAS), a GPWS control panel, two warning lights and two TERRain ON ND mode P/BSWs. The EGPWS (T2CAS-TAWS) is connected to various navigation systems:
- weather radar (WXR),
- RA,
- Air Data/Inertial Reference System (ADIRS),
- ILS,
- and so on...

It processes the navigation data and generates alarms.
The T2CAS is made of a single Line Replaceable Unit (LRU). Controls of the T2CAS are similar to the EGPWS ones.

UGB13131 - U7ST0M0 - UM34P900000001


GPWS
TERR
SYS
G/S MODE
FLAP MODE
LDG FLAP 3
FAULT
OFF
FAULT
OFF
OFF
OFF
ON
(21VU)
ENHANCED GROUND PROXIMITY WARNING COMPUTER (EGPWC)
OR
TRAFFIC AND TERRAIN COLLISION AVOIDANCE SYSTEM (T2CAS) COMPUTER
301VU
PULL UP
GPWS
403VU
TERR ON ND
ON
TERR ON ND
ON
500VU
PULL UP
GPWS
CAPTAIN LIGHTING & LOUDSPEAKER CONTROL PANEL
LANDING GEAR CONTROL & INDICATING PANEL (402VU)
F/O LIGHTING & LOUDSPEAKER CONTROL PANEL
OPTION

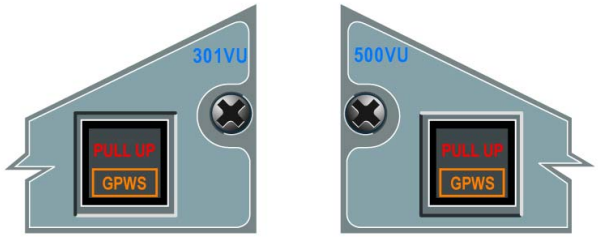
COMPONENTS

EGPWS PRESENTATION (2)

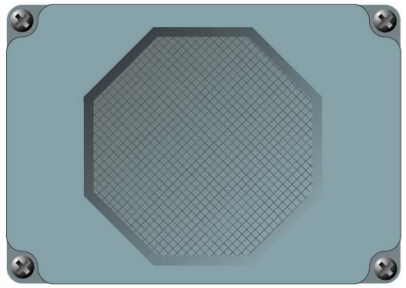
INDICATING

The basic GPWS modes generate visual warnings through associated lights and synthetic warnings through the loudspeakers. The "ENHANCED" GPWS functions allow the terrain hazards to be displayed on the NDs. Optionally, the NDs can also display the obstacle hazards as well as highest and lowest elevations known as peaks mode.
The EGPWS and the T2CAS have very similar principles (same layer colorations). Both systems provide an anticipated background display in descent (approximately 30 sec).

NOTE: The T2CAS has one specific feature, which is the AVOID TERRAIN display. This unique warning is provided to immediately notify the crew that the normal recovery will not work.

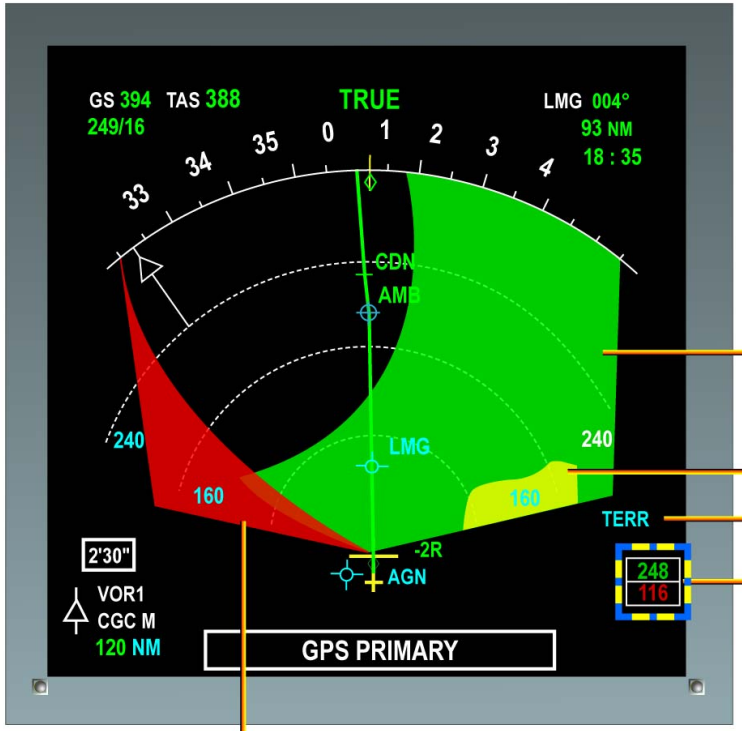


CAPTAIN & F/O
LIGHTING & LOUDSPEAKER
CONTROL PANEL



CAPT & F/O LOUDSPEAKER (2 & 6VU)

NAVIGATION DISPLAY (ND)



TERRAIN ALTITUDE SUFFICIENTLY BELOW THE A/C (GREEN)

CAUTION CRITERIA (YELLOW)

CYAN MESSAGE

HIGHEST AND LOWEST ELEVATIONS

WARNING CRITERIA (RED)

OPTIONAL

INDICATING

EGPWS DESCRIPTION/OPERATION (3)

GENERAL

The Enhanced Ground Proximity Warning System (EGPWS) has:
- 1 Enhanced Ground Proximity Warning Computer (EGPWC),
- 2 PULL UP/GPWS P/BSWs with integral lights,
- 1 GPWS control panel,
- 2 TERRain ON ND P/BSWs.

As an option, the Terrain Awareness and Warning system (TAWS) part of the Traffic and Terrain Collision Avoidance System (T2CAS) can replace the EGPWS. The T2CAS computer is a single Line replaceable Unit (LRU) for both Traffic Collision Avoidance System (TCAS) and TAWS functions. All cockpit hardware interfaces (lights, P/BSWs) for the T2CAS-TAWS remain identical to the EGPWS. The interfaces are also identical for the TAWS peripheral systems.

DIGITAL INPUTS

The EGPWS receives ARINC 429 data inputs from the navigation sensors in order to monitor the aircraft position with respect to the terrain and provide audio and visual warnings when in hazardous situation.

DIGITAL OUTPUTS

An ARINC 429 transmitter provides a maintenance output data bus. This output bus is used by the Centralized Fault Display Interface Unit (CFDIU) for maintenance purposes and by the Aircraft Integrated Data System (AIDS) for the Data Management Unit (DMU), part of the Flight Data Interface and Management Unit (FDIMU).

ENHANCED FUNCTIONS

The EGPWC outputs a display of terrain data in ARINC 453 data bus format to the Display Management Computers (DMCs). The terrain data is displayed on the NDs automatically instead of the radar image when a terrain caution or warning is detected or any time by using the TERR ON ND P/BSWs. The EGPWS receives the Predictive WindShear (PWS) alerts from the weather radar hazard bus to determine the priority. The PWS has priority over EGPWS modes.
The EGPWC uses preferably GPS position, then IRS latitude and longitude data as valid position source and, if these positions are downgraded, then FMS position will be used.
Two architectures are available to receive GPS data. The first one uses the ADIRS connection as GPS data are transmitted via the IR1 bus, and the second one will use a direct connection between EGPWC and MMR1 if ADIRU1 is not able to transmit GPS data.

EGPWS CONTROLS

Various P/BSWs let the crew control the actions of the EGPWS. When pressed in, on the GPWS control panel:
- the TERR P/BSW with the white OFF legend, inhibits the Terrain Awareness Display (TAD) and the Terrain Clearance Floor (TCF) modes,
- the SYStem P/BSW with the white OFF legend, inhibits all the GPWS warnings (mode 1 to 5),
- the Glide/Slope MODE P/BSW with the white OFF legend, inhibits the G/S mode (mode 5),
- the FLAP MODE P/BSW with the white OFF legend, inhibits flap abnormal condition input (mode 4) and generates the green "GPWS FLAP MODE OFF" memo on the left memo area of the EWD,
- the LanDinG FLAP 3 P/BSW with the white ON legend selects the landing FLAP 3 position and generates the green "GPWS FLAP 3" memo on the right memo area of the EWD.

When pressed in, the PULL UP GPWS P/BSW on the instrument panels has two functions:
- it sends a ground signal to trigger the self test sequence,
- it cancels the G/S aural and visual warnings when triggered.

When the TERR ON ND P/BSW is pressed in, on the center instrument panel, the green ON legend comes on to indicate that terrain data is shown on the ND.

AURAL WARNINGS

The audio output is used to broadcast aural warning messages, which identify the activated mode. When the EMERgency CANCel key on the ECAM Control Panel (ECP) is pressed, an audio suppression signal is sent to the EGPWC in order to momentarily cancel the EGPWS warnings.

VISUAL WARNINGS

In hazardous flight configurations or system failures, the EGPWC sends discretes for the lighting of warning legends. Five discretes control the warning legends:
- one for red PULL UP legends, comes on red when the second boundary of Mode 1 is penetrated or when Mode 2, or any TAD or TCF alert is activated,
- one for amber GPWS legends, comes on amber when any other mode is activated.
- two monitor outputs for the amber FAULT legends on the SYS and TERR P/BSWs of the GPWS control panel. These discretes are also sent to the System Data Acquisition Concentrators (SDACs) to generate the ECAM "GPWS FAULT" and "GPWS TERR DET FAULT" warning messages,
- one monitor output for the availability of the terrain mode. In case of Flight Management System (FMS) low accuracy a green TERR STBY is sent through the SDACs to the right memo area of the EWD.

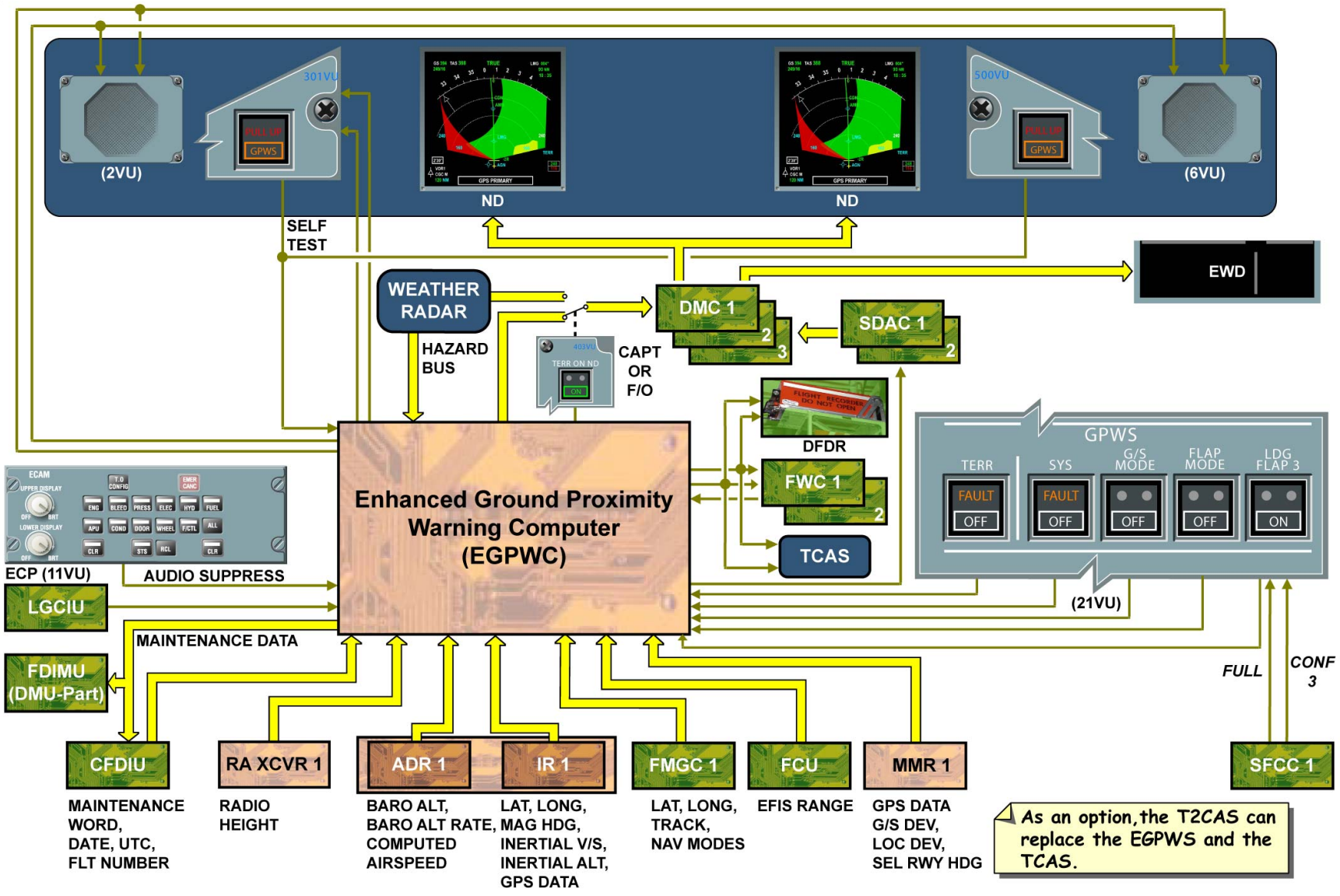
FWC

The Flight Warning Computers (FWCs) send a discrete to the EGPWC to inhibit all warnings when a stall or windshear warning is triggered. The EGPWC sends two discretes to the FWCs and the Traffic alert and Collision Avoidance System (TCAS) in order to inhibit auto call out and low speed warnings and change TCAS mode from Resolution Advisory (RA) to Traffic Advisory (TA) when the PULL UP or GPWS warnings are in progress. These discretes are also used by the Digital Flight Data Recorder (DFDR).

LGCIU

The Landing Gear Control and Interface Unit (LGCIU) sends a flight/ground discrete signal to the EGPWC BITE to count the flight legs. This discrete is also used for Mode 4: Unsafe terrain clearance.

UGB13131 - U7ST0M0 - UM34DE000000001



GENERAL ... LGCIU

This Page Intentionally Left Blank

EGPWS DESCRIPTION/OPERATION (3)

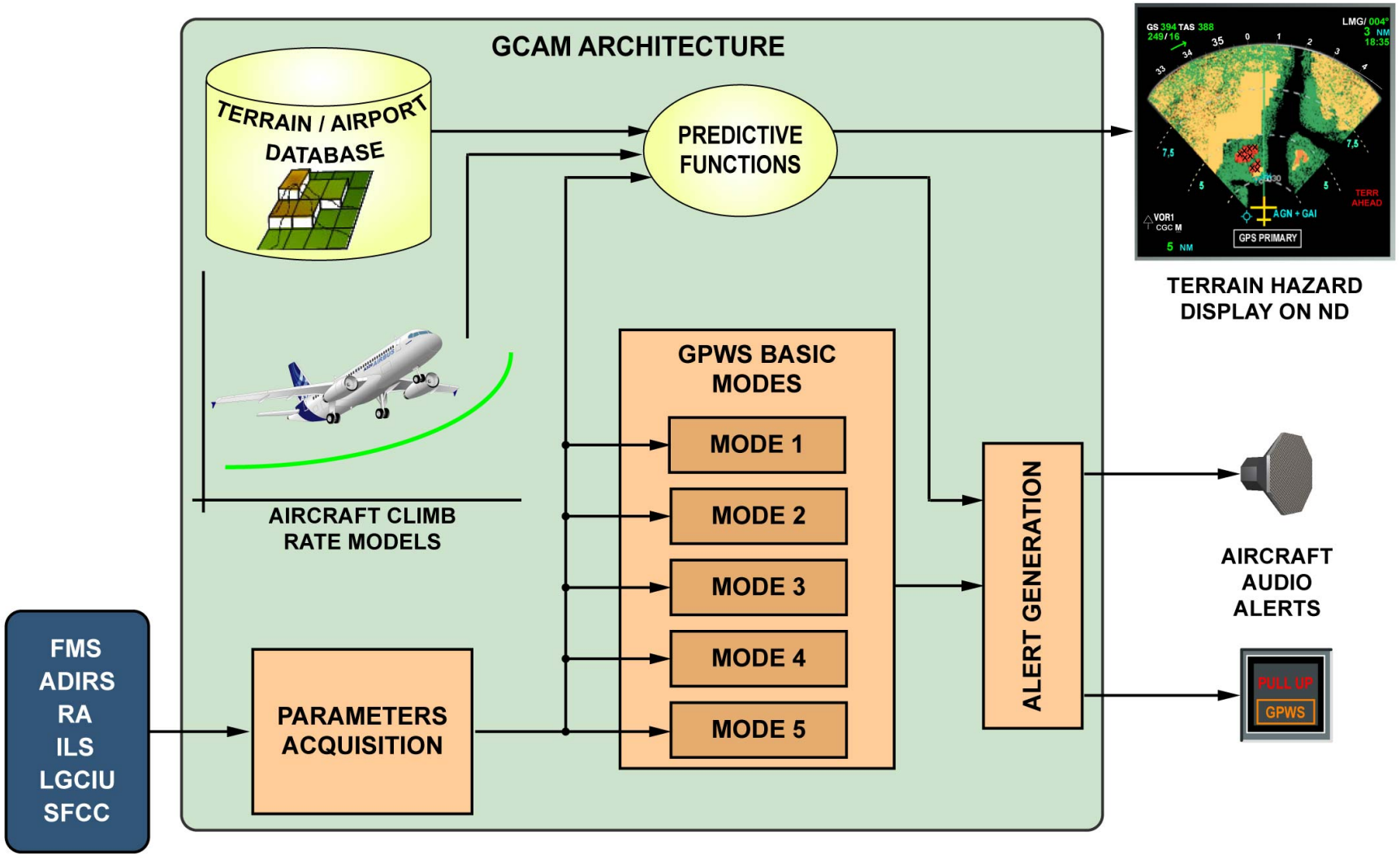
T2CAS

The following alerting function are integrated in the T2CAS-TAWS part:
- basic GPWS functions (Modes 1 to 5), mainly based on Radio Altitude,
- predictive modes: Collision Prediction and Alerting (CPA) function and Terrain Hazard Display (THD) function, which provides a forward-looking terrain avoidance and premature descent alert functions.

NOTE: The basic GPWS modes 1 and 2 are automatically inhibited when CPA and THD functions are operating. Optionally, an automatic deactivation of predictive function upon navigation high/low accuracy criteria can be activated, if the TAWS logic uses the Flight Management System (FMS) 1 lateral position. When this option is activated, the predictive mode is deactivated if the navigation accuracy is low. The green "TERR STBY" ECAM memo is displayed and mode 1 and 2 are reactivated.

The Ground Collision Avoidance Module (GCAM) ensures a very low rate of nuisance alerts to keep the crew confident in the generated alerts. It addresses some specific situations such as situations of normal aircraft operation according to procedures at altitudes significantly below the surrounding local terrain height (approaches in steep valleys). If GCAM predicts that the A/C can not climb over the terrain with sufficient safety margin:
- the aural "AVOID TERRAIN" warning is triggered,
- visual black crosses are displayed in the solid red on the ND.

NOTE: The T2CAS is not compatible with the weather radar autotilt function for ground clutter suppression.


GCAM ARCHITECTURE
TERRAIN / AIRPORT DATABASE
PREDICTIVE FUNCTIONS
TERRAIN HAZARD DISPLAY ON ND
GPWS BASIC MODES
MODE 1
MODE 2
MODE 3
MODE 4
MODE 5
AIRCRAFT CLIMB RATE MODELS
ALERT GENERATION
AIRCRAFT AUDIO ALERTS
FMS
ADIRS
RA
ILS
LGCIU
SFCC
PARAMETERS ACQUISITION
PULL UP
GPWS

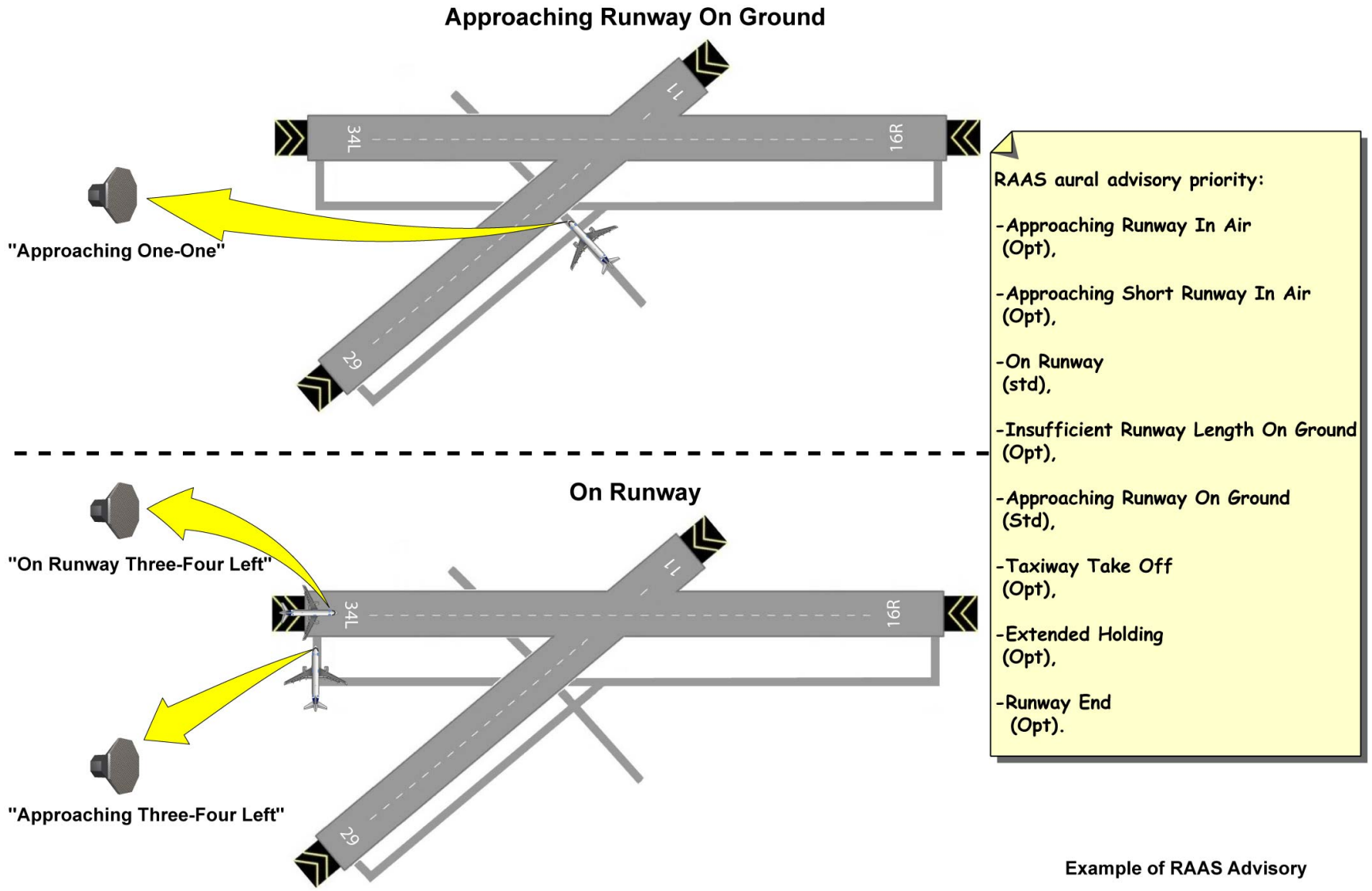
T2CAS

EGPWS DESCRIPTION/OPERATION (3)

RUNWAY AWARENESS AND ADVISORY SYSTEM (OPTIONAL)

In addition, the Runway Awareness and Advisory System (RAAS) is an optional software enhancement hosted in the EGPWS Unit. The RAAS uses GPS position data and the EGPWS Database to provide aural advisories for flight crew awareness during ground operations and on approach to landing to avoid runway incursions or collisions. The RAAS operates automatically without any action required from the flight crew. An EGPWS self test can verify the availability of this function.
RAAS aural advisory priority:
- Approaching Runway In Air (Opt),
- Approaching Short Runway In Air (Opt),
- On Runway (std),
- Insufficient Runway Length On Ground (Opt),
- Approaching Runway On Ground (Std),
- Taxiway Take Off (opt),
- Extended Holding (Opt),
- Runway End (Opt).

UGB13131 - U7ST0M0 - UM34DE000000001



RUNWAY AWARENESS AND ADVISORY SYSTEM (OPTIONAL)

EGPWS MODES (3)

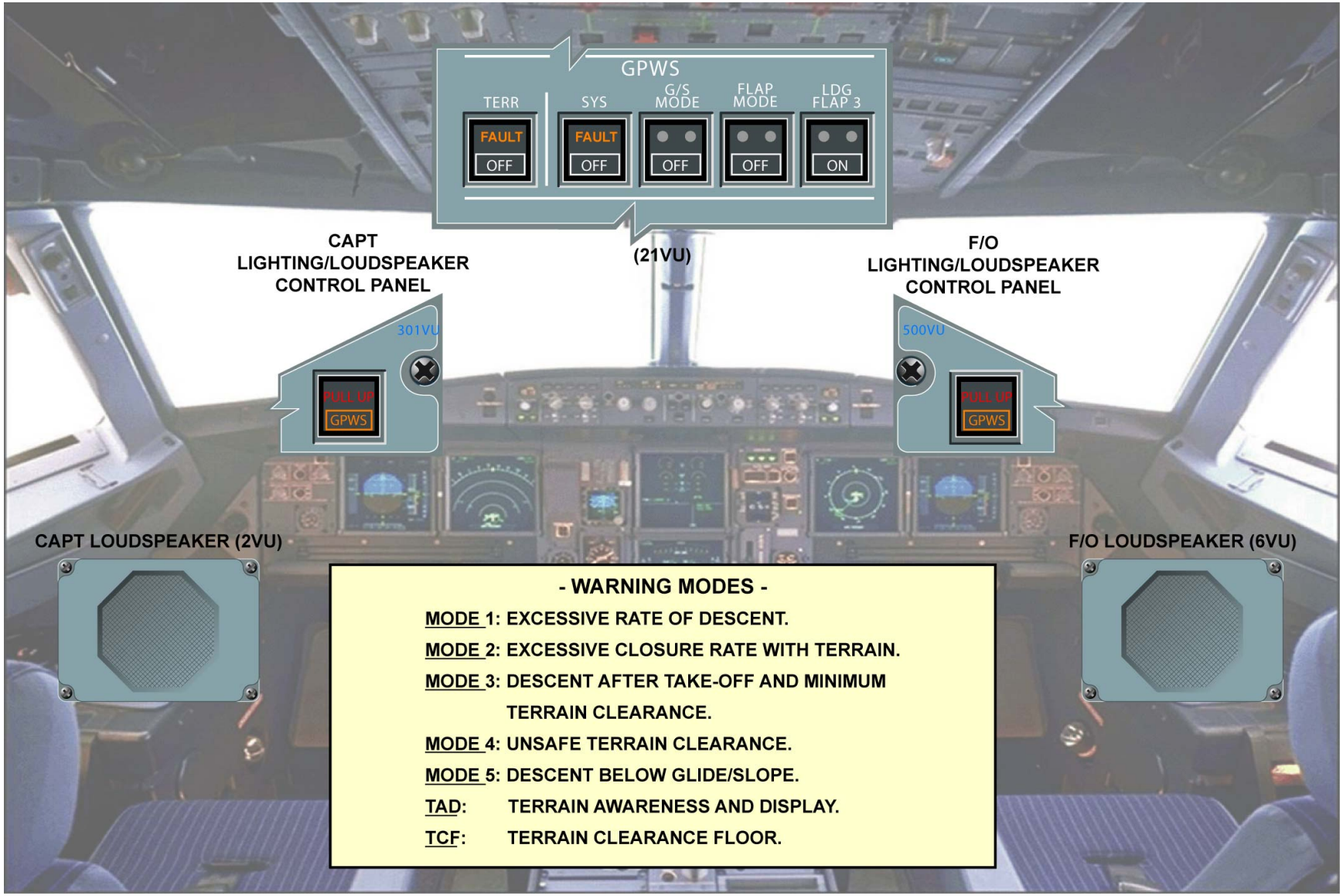
GENERAL

The Enhanced Ground Proximity Warning System (EGPWS) (or T2CAS-TAWS if installed) computes and compares the aircraft behavior with a predetermined envelope.

WARNING MODES

When the warning envelope is penetrated, visual and aural warnings are generated. The aural messages are broadcast through the cockpit loudspeakers and visual warnings are indicated by the PULL UP Ground Proximity Warning System P/BSWs lights. A terrain image is displayed on the NDs. A number of airports through the world have approaches or departures, which are not entirely compatible with the standard GPWS operation. These airports are identified in the database, the GPWS recognizes them and modifies the profile and triggers the warning in accordance.

UGB13131 - U7ST0M0 - UM34DF000000001



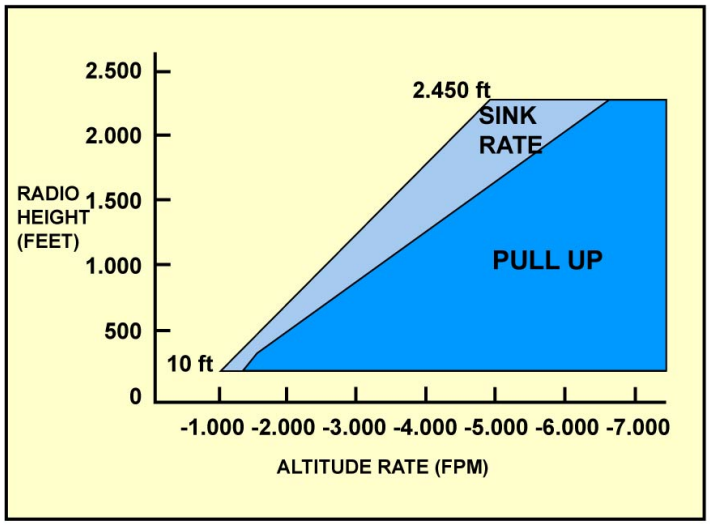
GENERAL & WARNING MODES

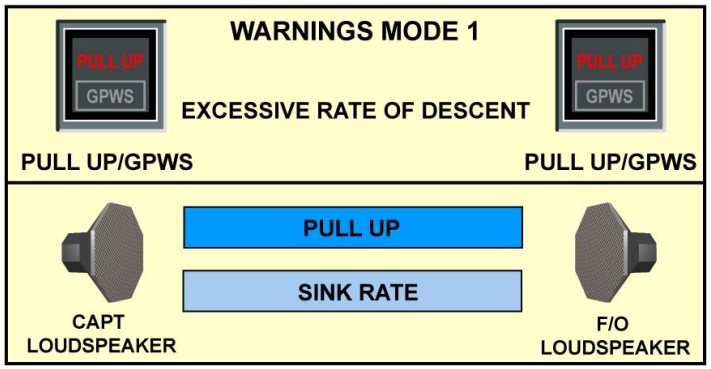
EGPWS MODES (3)

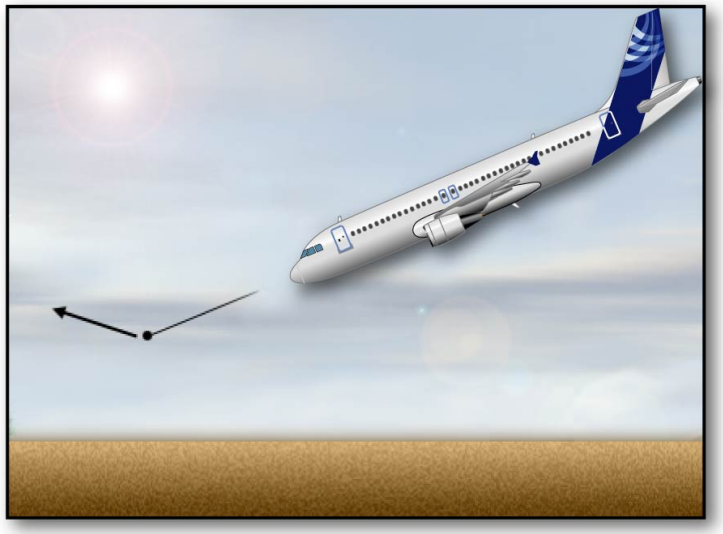
MODE 1

Mode 1 provides an alert warning for high descent rates into terrain and for rapidly increasing sink rates near the runway when landing. [Mode 1 has two boundaries. Penetration of the first boundary generates a repeated "SINK RATE" aural alert and causes both GPWS lights to come on. Penetration of the second boundary generates a repetitive "PULL UP" aural alert and causes both PULL UP lights to come on.

UGB13131 - U7ST0M0 - UM34DF000000001







WARNING INHIBITIONS

ECP (11VU)

ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.

GPWS CTL PNL (21VU)

ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.

MODE 1

EGPWS MODES (3)

MODE 2

Mode 2 provides a warning based on the radio height and on how rapidly the radio height decreases. It has two areas of application known as mode 2A and 2B.

- 2A: Flaps not in landing configuration, and aircraft not on the glide slope beam.

Penetration of the boundary causes the GPWS lights to come on, and generates the repeated aural alert: "TERRAIN".

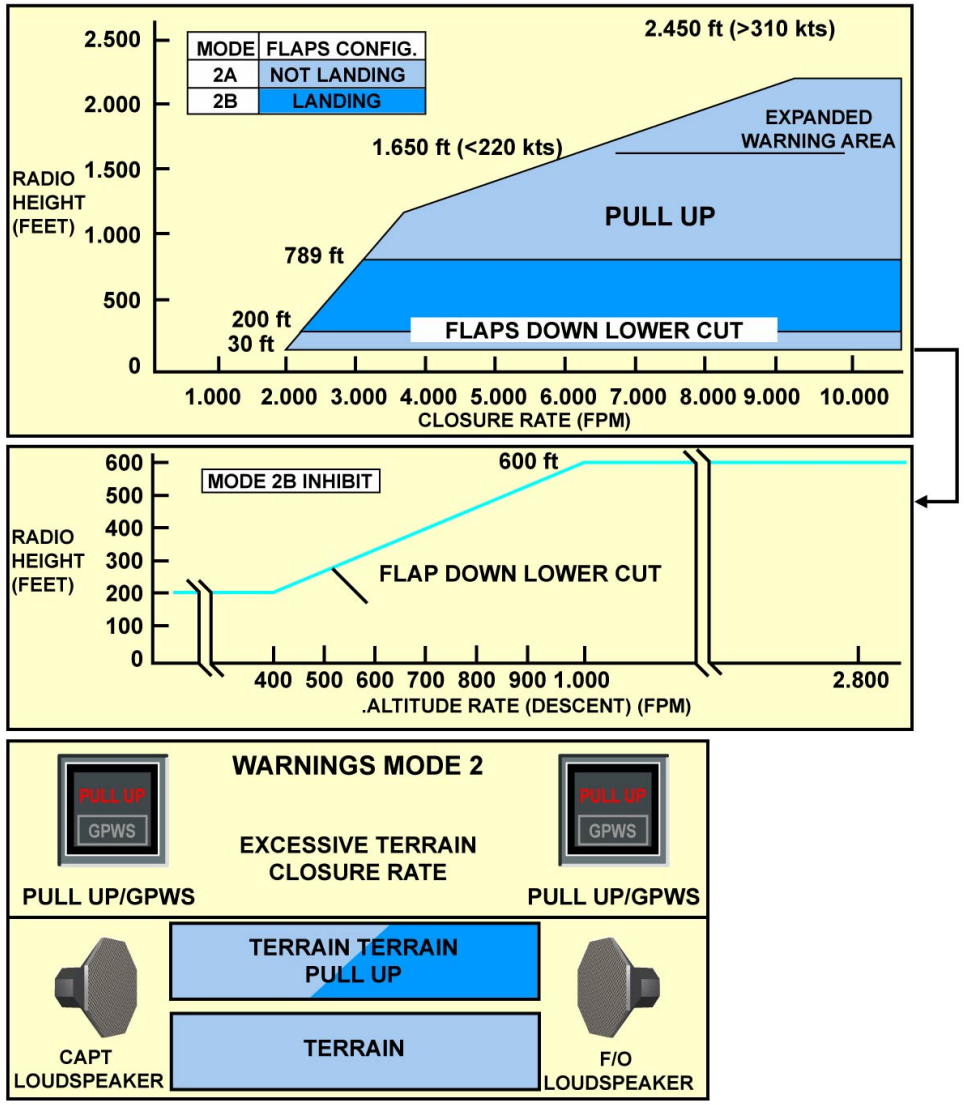
After "TERRAIN" has sounded twice, the warning switches to "PULL UP", repeated continually until the aircraft leaves the warning envelope. In addition, the PULL UP lights come on.

After the aircraft leaves the boundary, the PULL UP lights stay on and the "TERRAIN" aural message persists. These alerts stop when the aircraft increases either the barometric or inertial altitude by 300 feet.

- 2B: Flaps in landing configuration.

Lowering the flaps to the landing position automatically switches GPWS to mode 2B. In this case lower boundary varies between 200 feet and 600 feet depending on altitude rate. In ILS approach (glide slope deviation <± 2 dots) the lower boundary is fixed at 30 feet. When the aircraft enters the envelope, the alert is the same as for mode 2A. When gear and flaps are in the landing configuration, the aural message is "TERRAIN" only and is not followed by "PULL UP" if the aircraft remains in the envelope. When the enhanced GPWS functions and the optional geometric altitude function are of high integrity, the upper operational limit is reduced.

UGB13131 - U7ST0M0 - UM34DF000000001



WARNING INHIBITIONS

ECP (11VU)

ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.

GPWS CTL PNL (21VU)

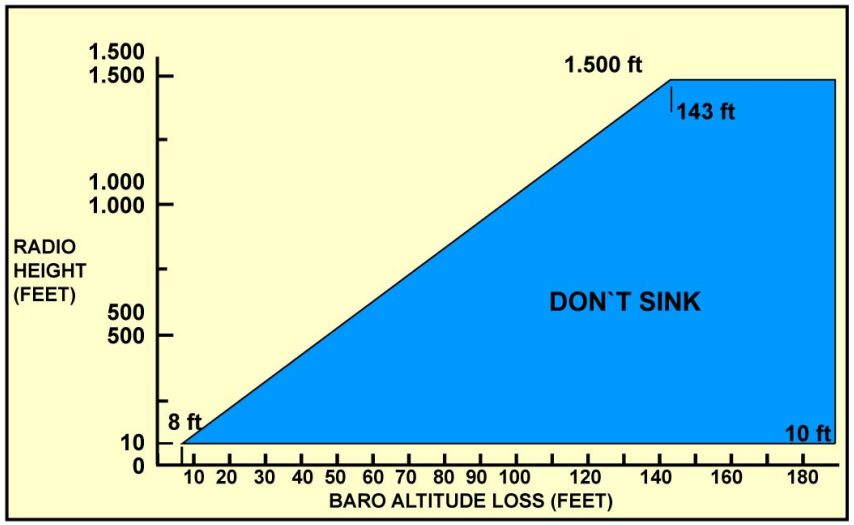
ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.

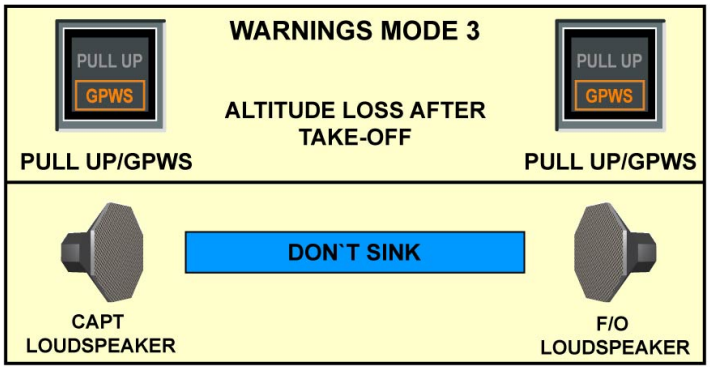
MODE 2

EGPWS MODES (3)

MODE 3

Mode 3 provides a warning for excessive altitude loss after take-off, climb or during a go-around. GPWS lights come on and the "DON'T SINK" aural alert sounds repeatedly. This mode is based on radio height, altitude (inertial, barometric or computed altitude) and altitude rate (Inertial Vertical Speed (IVS) computed altitude rate or barometric altitude rate).





WARNING INHIBITIONS

ECP (11VU)

ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.

GPWS CTL PNL
(21VU)

ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.

MODE 3

EGPWS MODES (3)

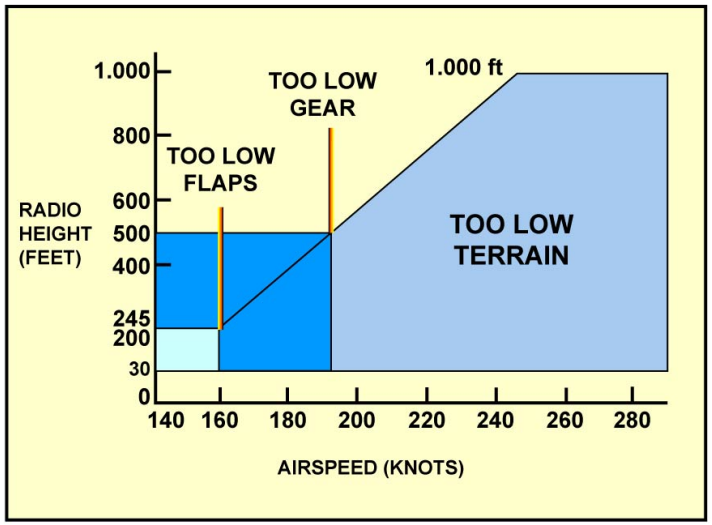
MODE 4

Mode 4 generates three type of voice warnings based on the radio height, computed airspeed and aircraft configuration. "TOO LOW TERRAIN" is broadcast when the aircraft is below 1.000 ft with landing gear retracted and/or flaps not in landing configuration. "TOO LOW GEAR or TOO LOW FLAPS" are broadcast depending on the aircraft configuration: gear up or down, flaps extended or retracted, aircraft speed in relation to the radio height.

NOTE: The "TOO LOW GEAR" message has priority over the "TOO LOW FLAPS" message.

When the enhanced GPWS functions and the optional geometric altitude function are of high integrity, the upper operational limit is reduced.

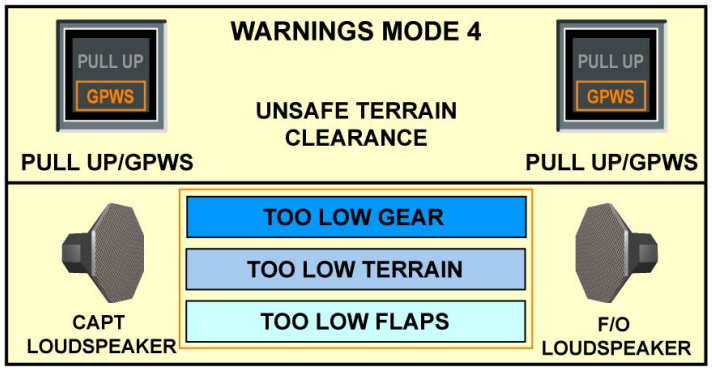
UGB13131 - U7ST0M0 - UM34DF000000001

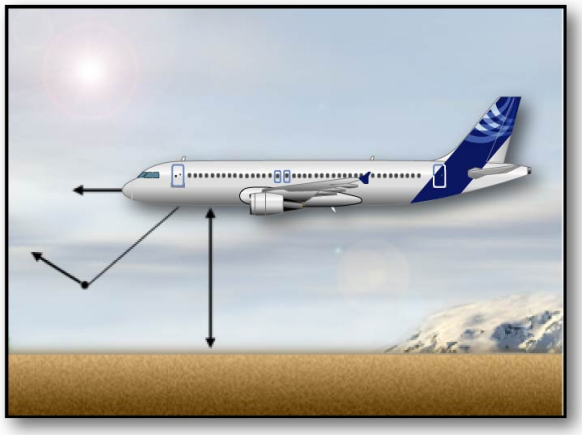


MODE 4A: GEAR AND FLAPS UP

MODE 4B: GEAR OR FLAPS DOWN

MODE 4C: GEAR OR FLAPS UP (DURING TAKE-OFF)





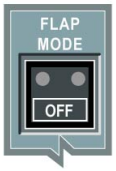
WARNING INHIBITIONS

ECP (11VU)

ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.

GPWS CTL PNL (21VU)

ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.



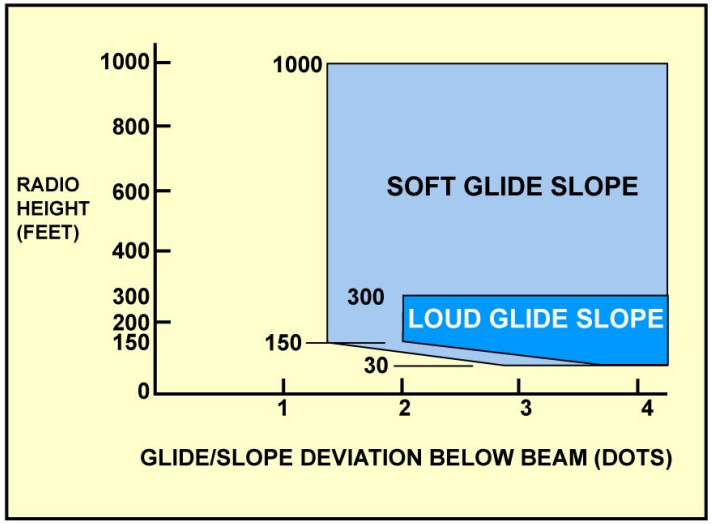
ON THE GPWS CTL PNL, INHIBITS THE AURAL "TOO LOW FLAP" AND VISUAL WARNINGS.

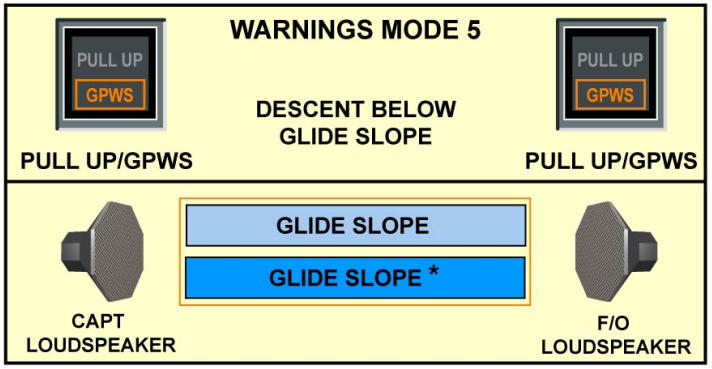
MODE 4

EGPWS MODES (3)

MODE 5

Mode 5 provides warnings when the aircraft flight path descends below the G/S beam during ILS approaches. The loudness of the "GLIDE SLOPE" voice message and the repetition rate are increased when closing to the ground.





WARNING INHIBITIONS

ECP (11VU)	EMER CANC	ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.
GPWS CTL PNL (21VU)	TERR FAULT OFF	ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.
GPWS CTL PNL (21VU)	G/S MODE OFF	ON THE GPWS CTL PNL, INHIBITS THE AURAL AND VISUAL WARNINGS.
LIGHTING/ LOUDSPEAKER CTL PNL (301 & 500VU)	PULL UP GPWS	ON THE LIGHTING/LOUDSPEAKER CONTROL PANEL, INHIBITS THE AURAL AND VISUAL WARNINGS.

* VOICE MESSAGE INCREASES

MODE 5

EGPWS MODES (3)

TAD (JAA & FAA)

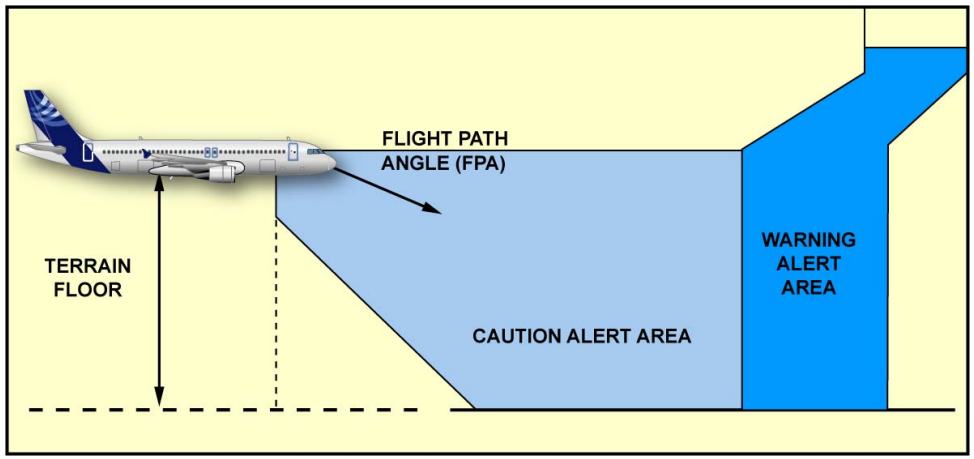
When a terrain threat forward of the aircraft path is detected, with respect to the aircraft position and the local terrain database, caution and warning alerts are triggered. When the envelope boundaries are met the following alerts are generated:
- terrain caution alert: "TERRAIN AHEAD" is broadcast for Joint Aviation Authorities (JAA) regulations or "CAUTION TERRAIN, CAUTION TERRAIN" for Federal Aviation Administration (FAA) regulations,
- terrain warning alert: "TERRAIN AHEAD, PULL UP" is broadcast for JAA regulations or "TERRAIN, TERRAIN, PULL UP" for FAA regulations.

When the optional obstacle function is activated the EGPWS can also generate the following alerts:
- obstacle caution alert: "OBSTACLE AHEAD" is broadcast for JAA regulations or "CAUTION OBSTACLE" for FAA regulations,
- obstacle warning alert: "OBSTACLE AHEAD, PULL UP" is broadcast for JAA regulations or "OBSTACLE, OBSTACLE, PULL UP" for FAA regulations.

These alerts are completed by a terrain image on the NDs:
- red area for warnings,
- yellow area for cautions.

As an option, the peaks function allows the display of the absolute terrain with the highest and lowest elevations.

UGB13131 - U7ST0M0 - UM34DF000000001

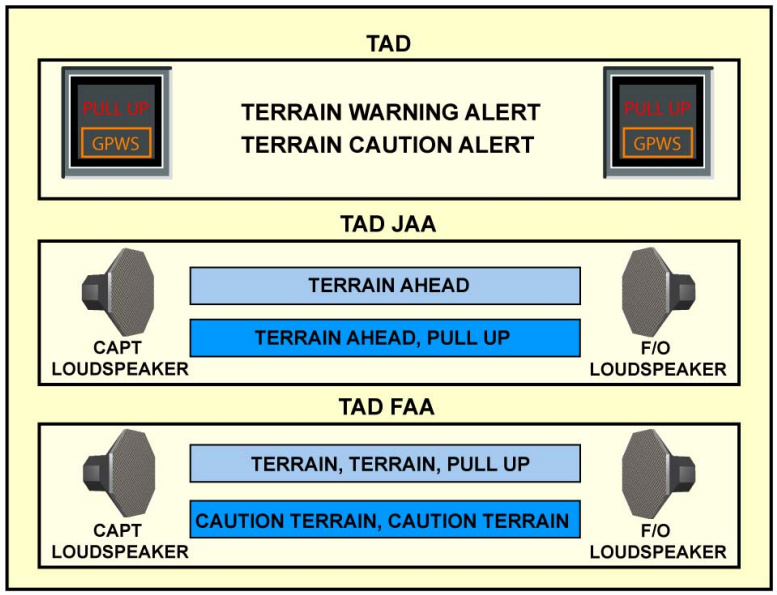


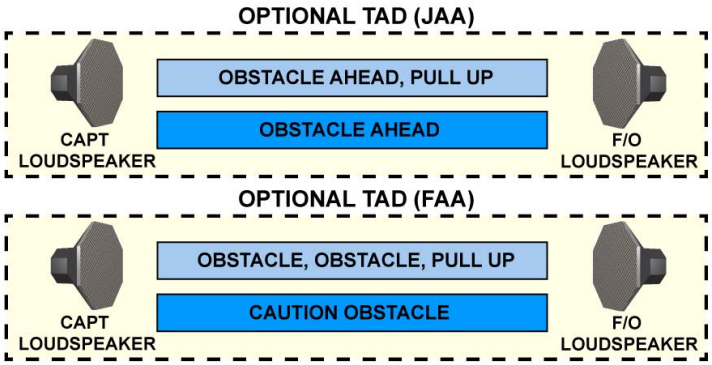
ENVELOPE BOUNDARIES

WARNING INHIBITIONS

ECP (11VU) — EMER CANC — ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.

GPWS CTL PNL (21VU) — TERR FAULT OFF — ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.



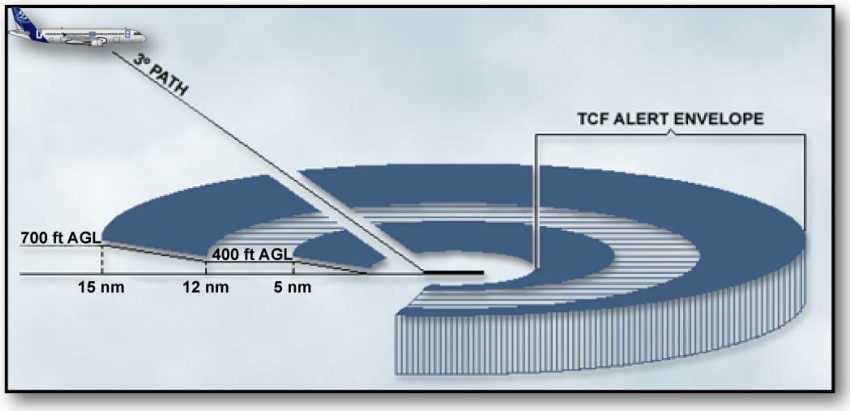


TAD (JAA & FAA)

EGPWS MODES (3)

TCF

The Terrain Clearance Floor (TCF) is an increasing terrain clearance envelope around the airport runway to provide protection against Controlled Flight Into Terrain (CFIT). The TCF alert function complements the existing Mode 4. When TCF alert envelope is penetrated "TOO LOW TERRAIN" is broadcast. It is based on current aircraft position, nearest runway center point position and RA.



TCF ALERT ENVELOPE

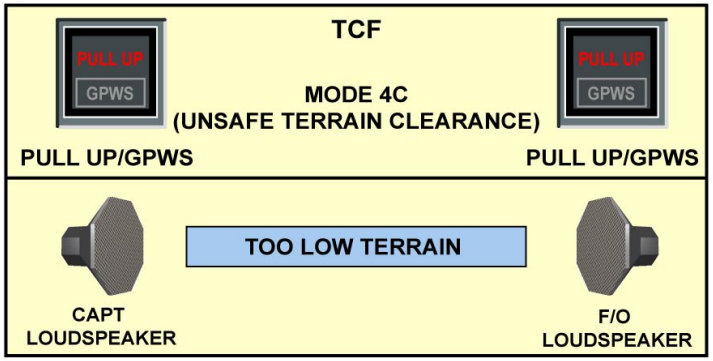
WARNING INHIBITIONS

ECP (11VU)

ON THE ECAM CTL PNL, INHIBITS AURAL WARNING.

GPWS CTL PNL (21VU)

ON THE GPWS CTL PNL, INHIBITS VISUAL AND AURAL WARNINGS.



TCF

EGPWS MODES (3)

EGPWS/T2CAS DIFFERENCES

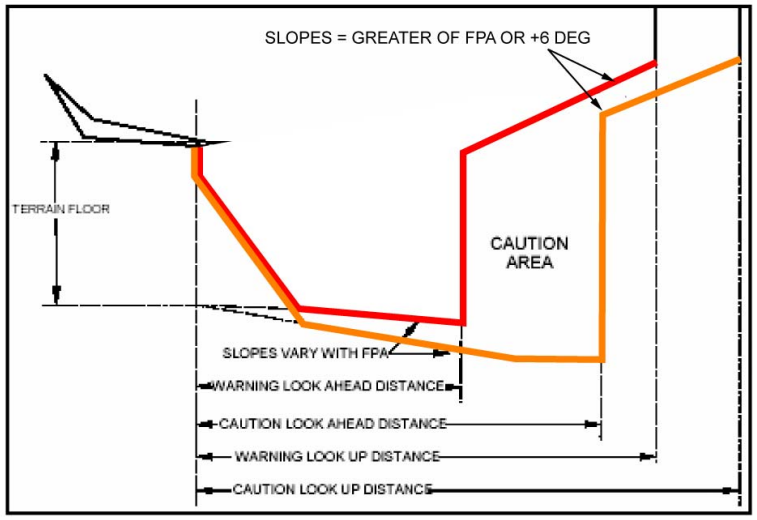
The EGPWS and T2CAS have different philosophies. The EGPWS keeps all modes active but desensitizes nuisance prone modes function of the predictive mode (TAD) integrity and aircraft location (through envelope modulation). The T2CAS inhibits mode 2 when the Collision Prediction and Alerting (CPA) is in normal operation and the CPA altitude crosscheck is correct.

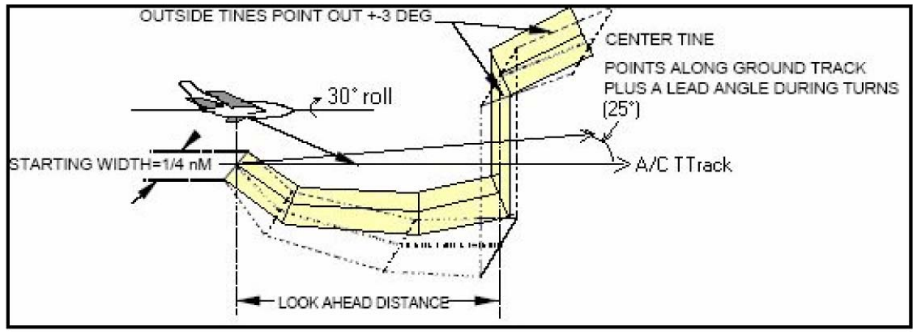
The EGPWS sensor includes a vertical margin (terrain floor) function of Vz and Runway proximity. This margin is directly applied on the terrain cells for T2CAS. The EGPWS and T2CAS both use a caution and a warning sensors projected in a terrain database. EGPWS assumed that the A/C could climb 6° all the time. The T2CAS takes into account real time aircraft climb capability to give an alert with guaranteed safety margins. If this safety margins is not sufficient, the AVOID TERRAIN alert is triggered to indicate to the pilot that a turn maneuver is recommended in addition to the PULL UP warning.

The EGPWS and the T2CAS have very similar display principles (same layer colorations). Both systems have an anticipated background display in descent (approximately 30 sec). The T2CAS has one specific feature, which is the AVOID TERRAIN display.

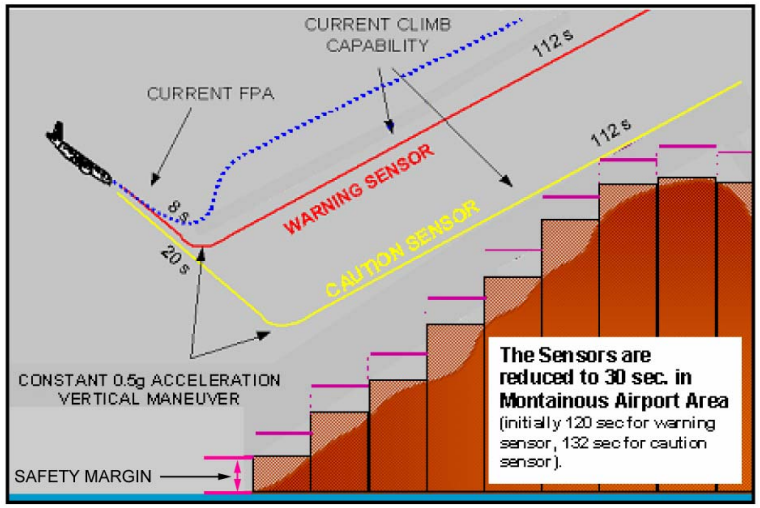
UGB13131 - U7ST0M0 - UM34DF000000001

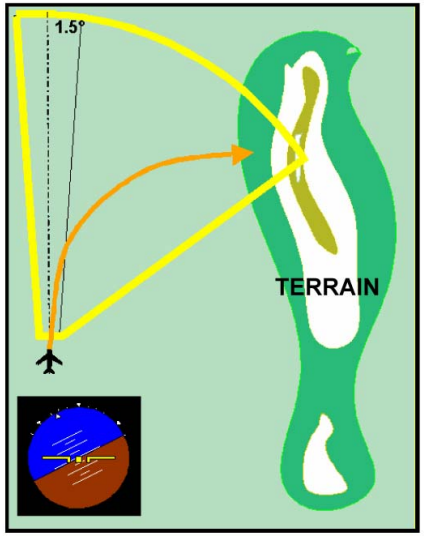
EGPWS


SLOPES = GREATER OF FPA OR +6 DEG
TERRAIN FLOOR
CAUTION AREA
SLOPES VARY WITH FPA
WARNING LOOK AHEAD DISTANCE
CAUTION LOOK AHEAD DISTANCE
WARNING LOOK UP DISTANCE
CAUTION LOOK UP DISTANCE

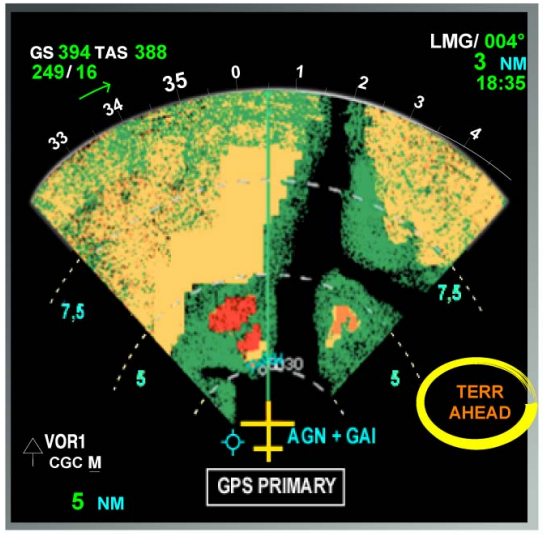


T2CAS



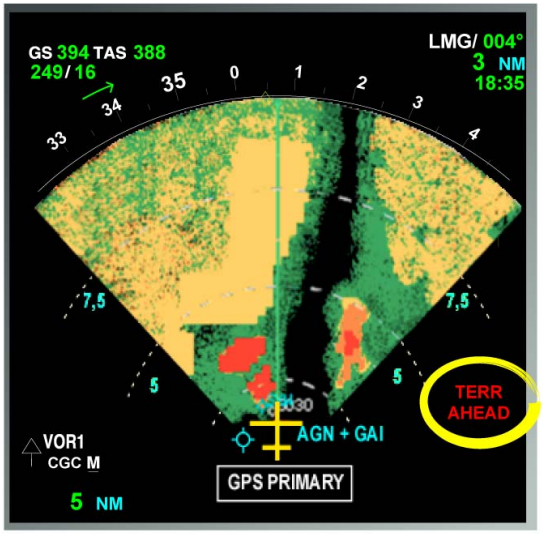


EGPWS/T2CAS DIFFERENCES



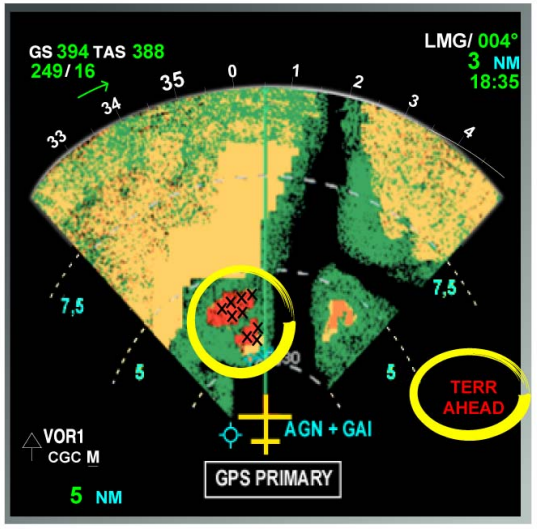
CAUTION

"TERRAIN AHEAD"



WARNING

"TERRAIN AHEAD, PULL UP"



WARNING

"AVOID TERRAIN"
(PRECEEDED AT LEAST BY "TERRAIN AHEAD, PULL UP")

EGPWS/T2CAS DIFFERENCES

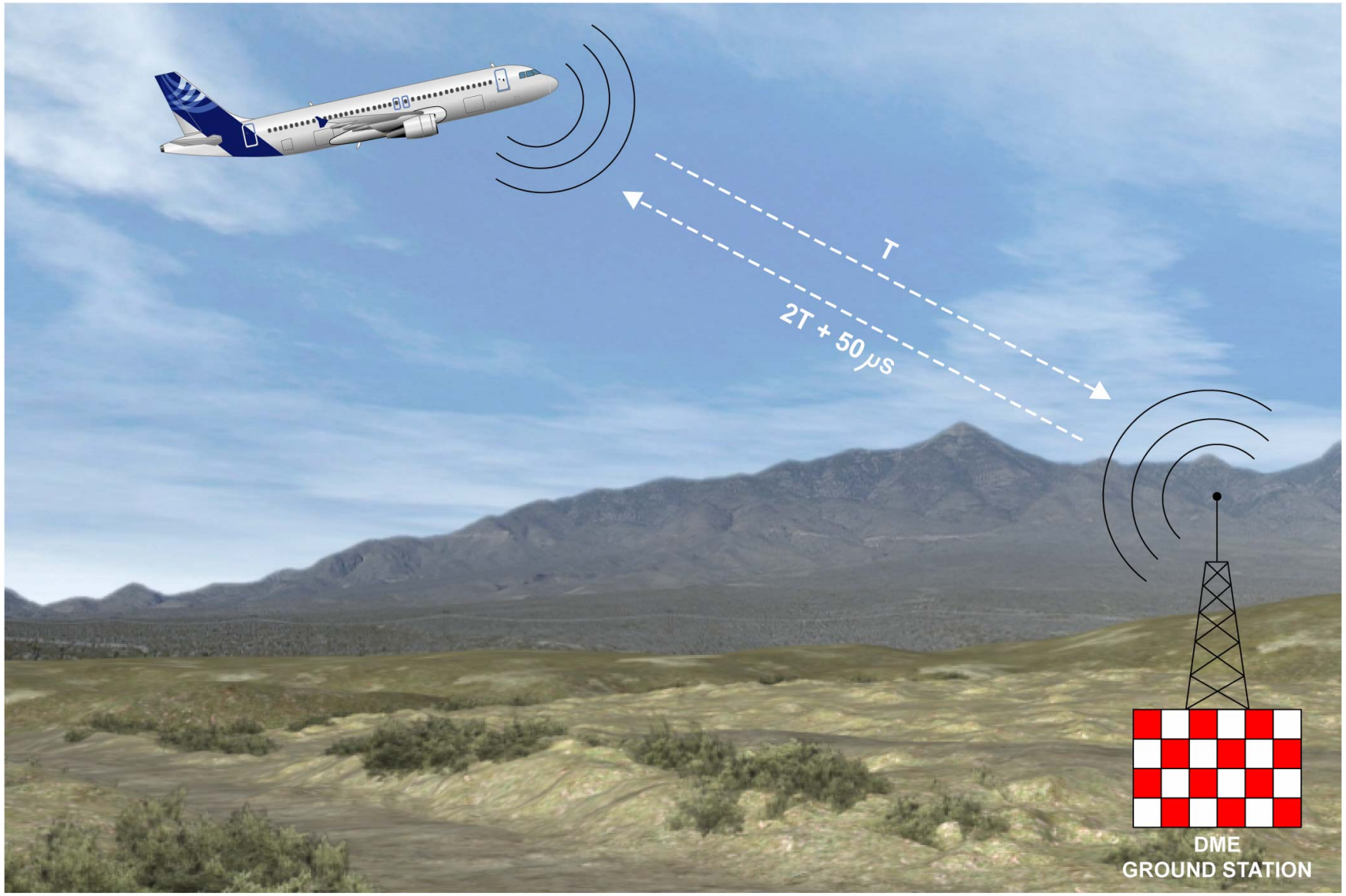
This Page Intentionally Left Blank

UGB13131 - U7ST0M0 - UM34DF000000001

DME SYSTEM PRESENTATION (2)

PRINCIPLE

The Distance Measuring Equipment (DME) provides digital readout of the aircraft slant range distance from a selected ground station. The system generates interrogation pulses from an onboard interrogator and sends them to a selected ground station. After a 50 microseconds delay, the ground station replies. The interrogator determines the distance in nautical miles between the station and the aircraft. The interrogator detects the Morse audio signal, which identifies the ground station.



PRINCIPLE

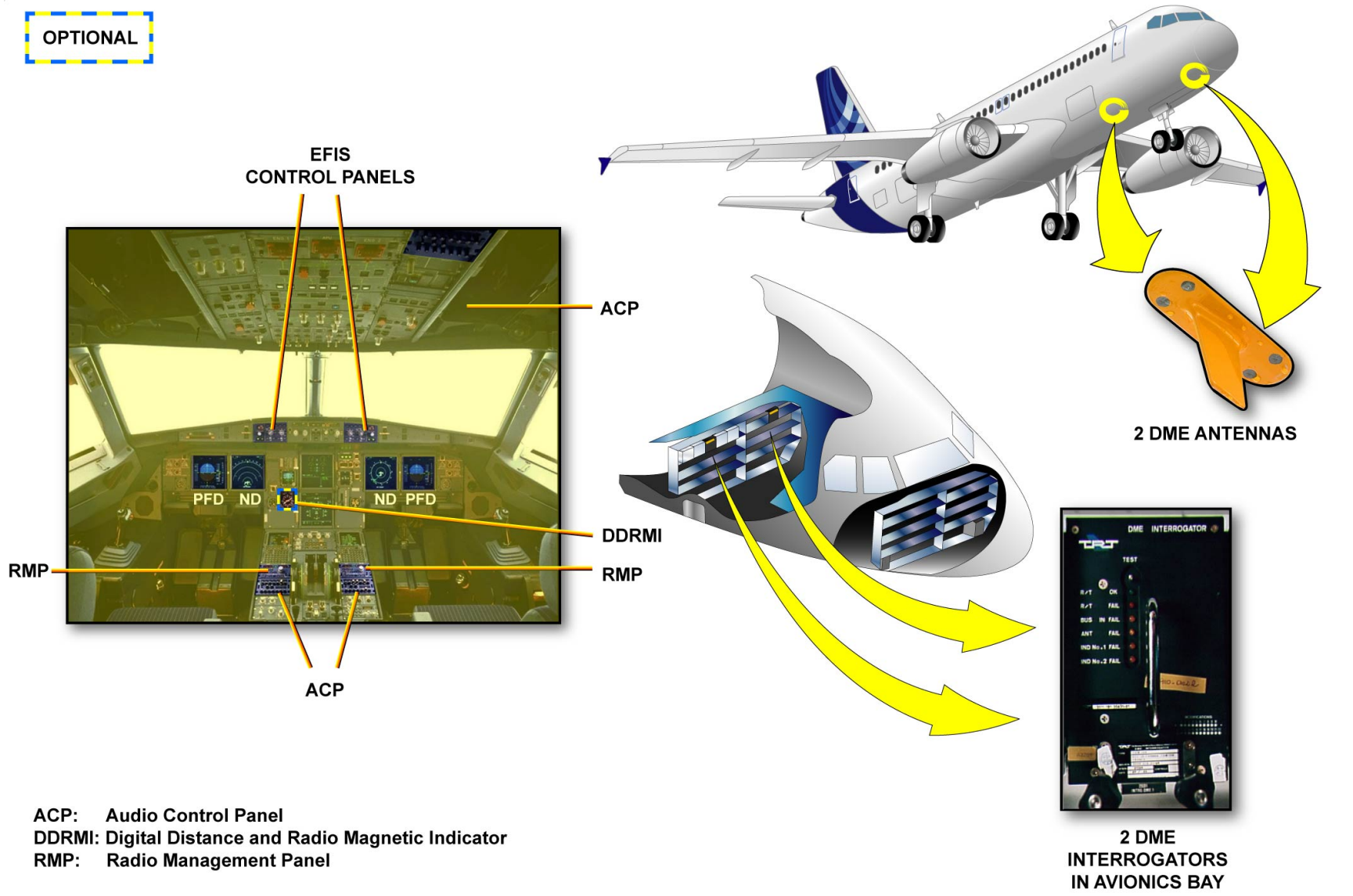
DME SYSTEM PRESENTATION (2)

COMPONENT LOCATION

The components are two antennas and two interrogators. The DME system is also connected to:
- PFDs, NDs and optional Digital Distance and Radio Magnetic Indicator (DDRMI) for display,
- EFIS control panels for display control,
- Flight Management and Guidance Computers (FMGCs) for automatic and manual tuning,
- CAPT and F/O Radio Management Panels (RMPs) for back-up tuning and,
- Audio Control Panels (ACPs) for DME audio signal.

The radio-navigation receiver antennas are installed on the lower fuselage.
Two DME interrogators are installed in the avionics bay.

UGB13131 - U7ST0M0 - UM34PA000000001



ACP: Audio Control Panel
DDRMI: Digital Distance and Radio Magnetic Indicator
RMP: Radio Management Panel

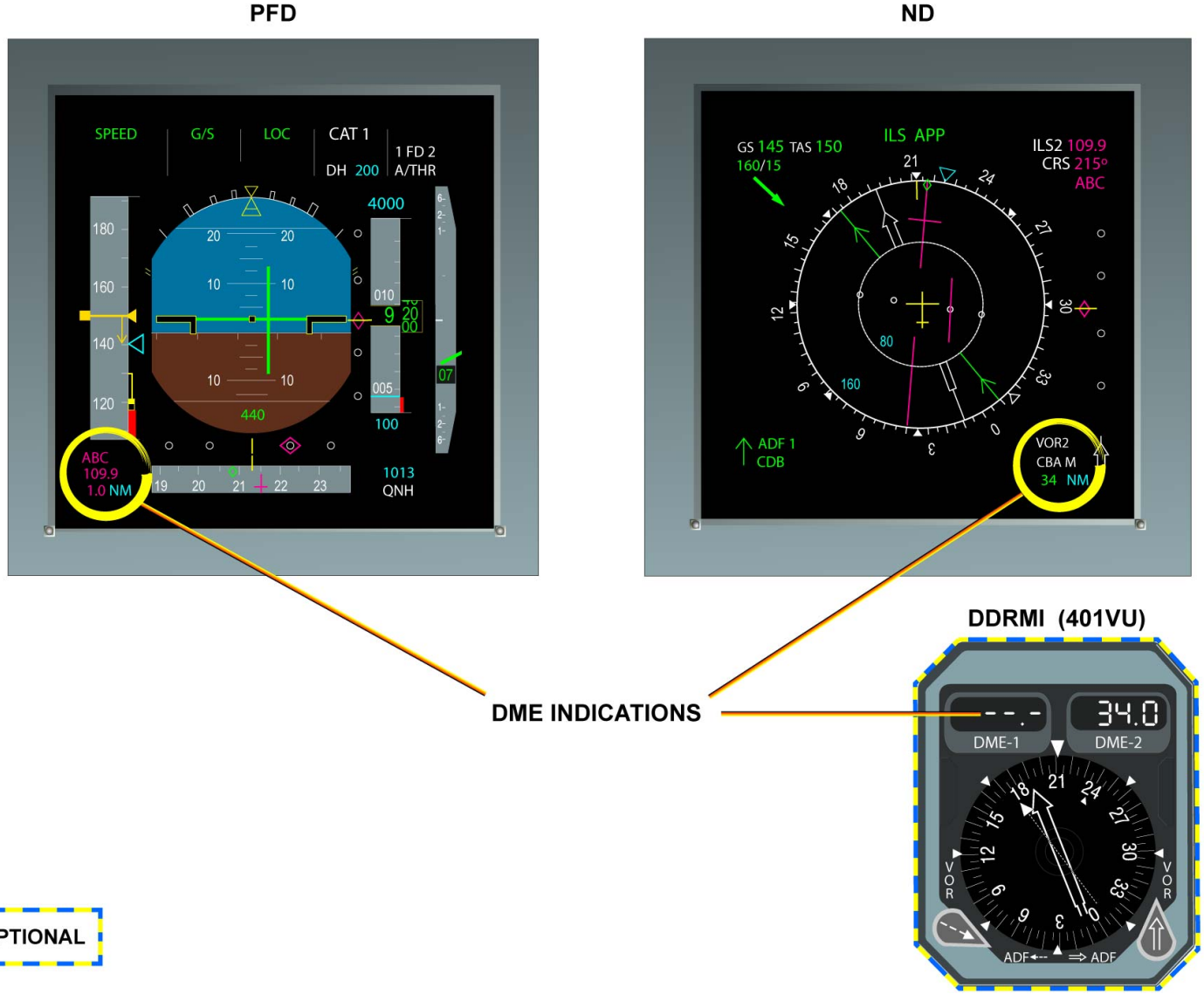
COMPONENT LOCATION

DME SYSTEM PRESENTATION (2)

INDICATING

The DME distance is shown on the PFD if the ILS display is selected via LS P/B and on the ND if the ADF/VOR selector is set to VOR. The DME distance is also shown on the two windows of the optional DDRMI.

UGB13131 - U7ST0M0 - UM34PA000000001


PFD
ND
SPEED
G/S
LOC
CAT 1
1 FD 2
A/THR
DH 200
4000
180
160
140
120
ABC
109.9
1.0 NM
1013
QNH
GS 145 TAS 150
160/15
ILS APP
ILS2 109.9
CRS 215°
ABC
ADF 1
CDB
VOR2
CBA M
34 NM
DME INDICATIONS
DDRMI (401VU)
DME-1
DME-2
34.0
VOR
ADF
OPTIONAL

INDICATING

DME DESCRIPTION/OPERATION (3)

GENERAL

The DME system includes:
- 2 DME interrogators and,
- 2 DME antennas.

AUTO TUNING

In normal operation each Flight Management and Guidance Computer (FMGC) automatically tunes its ownside DME interrogator through its ownside Radio Management Panel (RMP) via port A. With failure of one FMGC the other FMGC can control the DME interrogators, one directly, the other through its RMP. When the FMGC fails, the DME receives a discrete signal through the RMP to automatically select port B.

MANUAL TUNING

From each MCDU both DMEs can be manually tuned through their ownside FMGC (via port A).

BACK-UP TUNING

In case of dual FMGC failure the RMPs enable back-up tuning.

ANTENNA

The DME antenna transmits the DME interrogation and receives the reply from the selected ground station. The DME antenna operates within the low band from 962 MHz to 1213 MHz (1041 to 1150 MHz for interrogation and 962 to 1213 MHz for reply).

USERS

The DME data is sent to the FMGCs for radio distance computation.

SUPPRESSOR

The DME, the Air Traffic Control (ATC) and the Traffic Alert and Collision Avoidance System (TCAS) operate in the same frequency range. A suppressor coaxial between the ATC transponders, the TCAS and DME interrogators is necessary to prevent simultaneous transmission and to interrupt reception of the other systems.

AMU

The DME audio signals are transmitted to the Audio Management Unit (AMU) and then dispatched to the headsets and/or loudspeakers. The pilot can adjust the volume of the DME ground station by pressing the VOR P/B on the Audio Control Panel (ACP) or the LS P/B in case of collocated ILS/DME (if LS mode is selected on EFIS control panel).

LGCIU

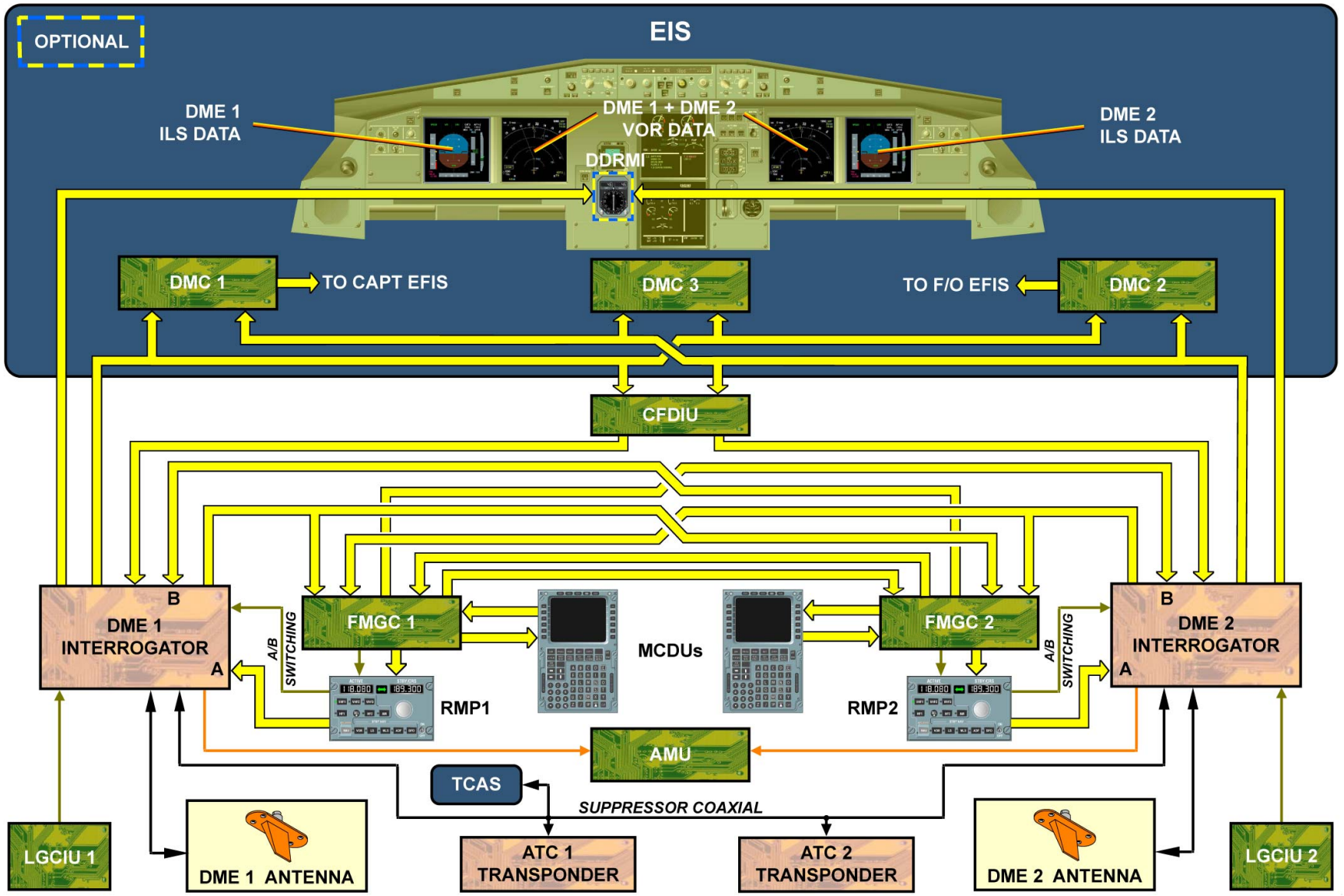
Each Landing Gear Control and Interface Unit (LGCIU) sends a discrete signal to the associated DME interrogator. This is a ground/flight information used by the receiver BITE module to count the flight legs.

INDICATING

DME data is sent to the NDs and the PFDs through the Display Management Computers (DMCs) and directly to the optional Digital Distance and Radio Magnetic Indicator (DDRMI).

CFDIU

The MCDUs allow the systems to be tested and trouble shooting to be performed via the Centralized Fault Display Interface Unit (CFDIU). The tests are only available on ground.



GENERAL ... CFDIU

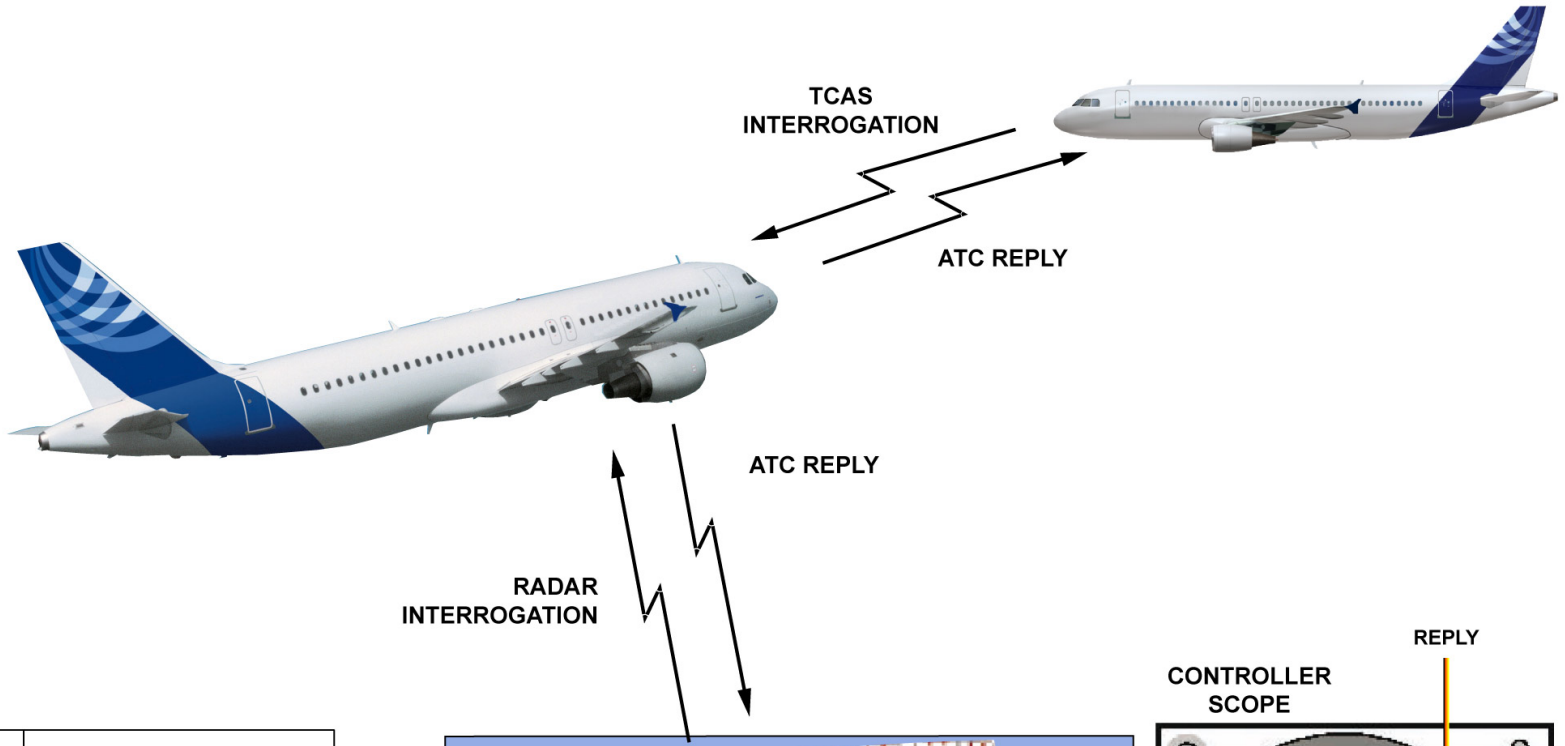
ATC SYSTEM PRESENTATION (2)

PRINCIPLE

The Air Traffic Control (ATC) transponder is an integral part of the Air Traffic Control Radar Beacon (ATCRB) system. The transponder is interrogated by radar pulses received from the ground station. It automatically replies by a series of pulses. These reply pulses are coded to supply:
- aircraft identification (Mode A),
- automatic altitude reporting (Mode C) and,
- selective calling and transmission of flight data of the aircraft on the ground controller's radar scope.

These replies enable the controller to distinguish the aircraft and to maintain effective ground surveillance of the air traffic. The ATC transponder (Mode S) also responds to interrogations from aircraft equipped with a Traffic Alert and Collision Avoidance System (TCAS).

NOTE: As an option, the Traffic and Terrain Collision Avoidance System (T2CAS) can replace the TCAS.



ATC MODE	INFORMATION ABOUT THE A/C
A	IDENTIFICATION
C	ALTITUDE
S	SELECTIVE CALL, FLIGHT DATA

PRINCIPLE

ATC SYSTEM PRESENTATION (2)

TRANSPONDER BASIC PRINCIPLES REVIEW

The Elementary Surveillance (ELS) is used for a basic communication between the Secondary Surveillance Radar (SSR) of the Air Traffic Control (ATC) ground station and the on-board ATC Transponder.
There are 2 frequencies: 1030 Mhz for SSR radar interrogation and 1090 Mhz for Transponder modulated by pulses for 3 modes:
- Mode A : identification,
- Mode C : Coded Barometric Altitude referenced to Standard Altitude (1013 Hpa) giving Flight Level,
- Mode S : Data Link - Used for TCAS, selective interrogation, and elementary surveillance.

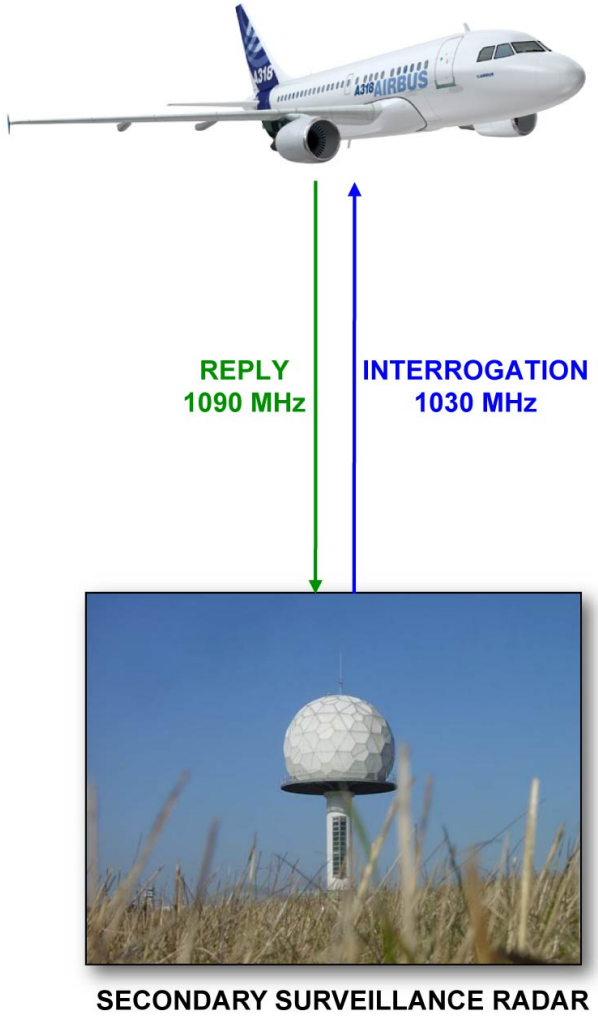
ELEMENTARY SURVEILLANCE WITH SSR MODES A, C, S

REMINDER ON TRANSPONDER BASICS :

- MODE A : SQAWK CODE - 0000 TO 7777 (4096 codes)
- MODE C : BAROMETRIC ALTITUDE REPORTING (flight level)
- MODE S : SELECTIVE INERROGATION - 24-BIT ADDRESS

ELEMENTARY SURVEILLANCE (ELS) :

- 24-BIT ADRESS
- FLIGHT NUMBER
- AIRCRAFT ALTITUDE (flight level)
- RA REPORT
- TRANSPONDEUR CAPABILITY REPORT
- ALTITUDE/GROUND REPORTING
- FLIGHT STATUS
- SURVEILLANCE IDENTIFIER (SI)



SECONDARY SURVEILLANCE RADAR

TRANSPONDER BASIC PRINCIPLES REVIEW

ATC SYSTEM PRESENTATION (2)

ENHANCED SURVEILLANCE (EHS) AND ADS-B DESCRIPTION (OPTIONS)

Enhanced surveillance parameters are transmitted to ATC in the same way as ELS. The mode S interrogation will request the enhanced surveillance parameters and the transponder will transmit them if the option is applied.
The specific parameters related to the enhanced surveillance are:
- selected altitude,
- barometric pressure setting,
- roll angle,
- track angle rate,
- true track angle,
- ground speed,
- true air speed,
- magnetic heading,
- indicated airspeed,
- mach,
- barometric altitude rate,
- inertial vertical velocity.

Extended squitters are transmissions from the transponder not requested from ATC (unsolicited).
The specific parameters related to the extended squitters are:
- altitude,
- longitude,
- latitude,
- movement,
- ground track,
- flight number,
- E/W velocity,
- N/S velocity,
- vertical rate.

UGB13131 - U7ST0M0 - UM34PB000000001

ELEMENTARY SURVEILLANCE (ELS)
TRANSPONDER MODES A, C, S

REPLY
1090 MHz

INTERROGATION
1030 MHz

SECONDARY SURVEILLANCE RADAR

ENHANCED SURVEILLANCE (EHS) WITH ADS-B
MODE S TRANSPONDER (NO ROUTING FROM ATSU)

ADS-B :

Automatic : No action required from flight crew

Dependant : Aircraft position provided by aircraft

Surveillance

Broadcast : Transmission of data without solicitation

ADS-B sends aircraft parameters :
- when the aircraft is in flight
- when the aircraft is on ground

ENHANCED SURVEILLANCE (EHS) AND ADS-B DESCRIPTION (OPTIONS)

ATC SYSTEM PRESENTATION (2)

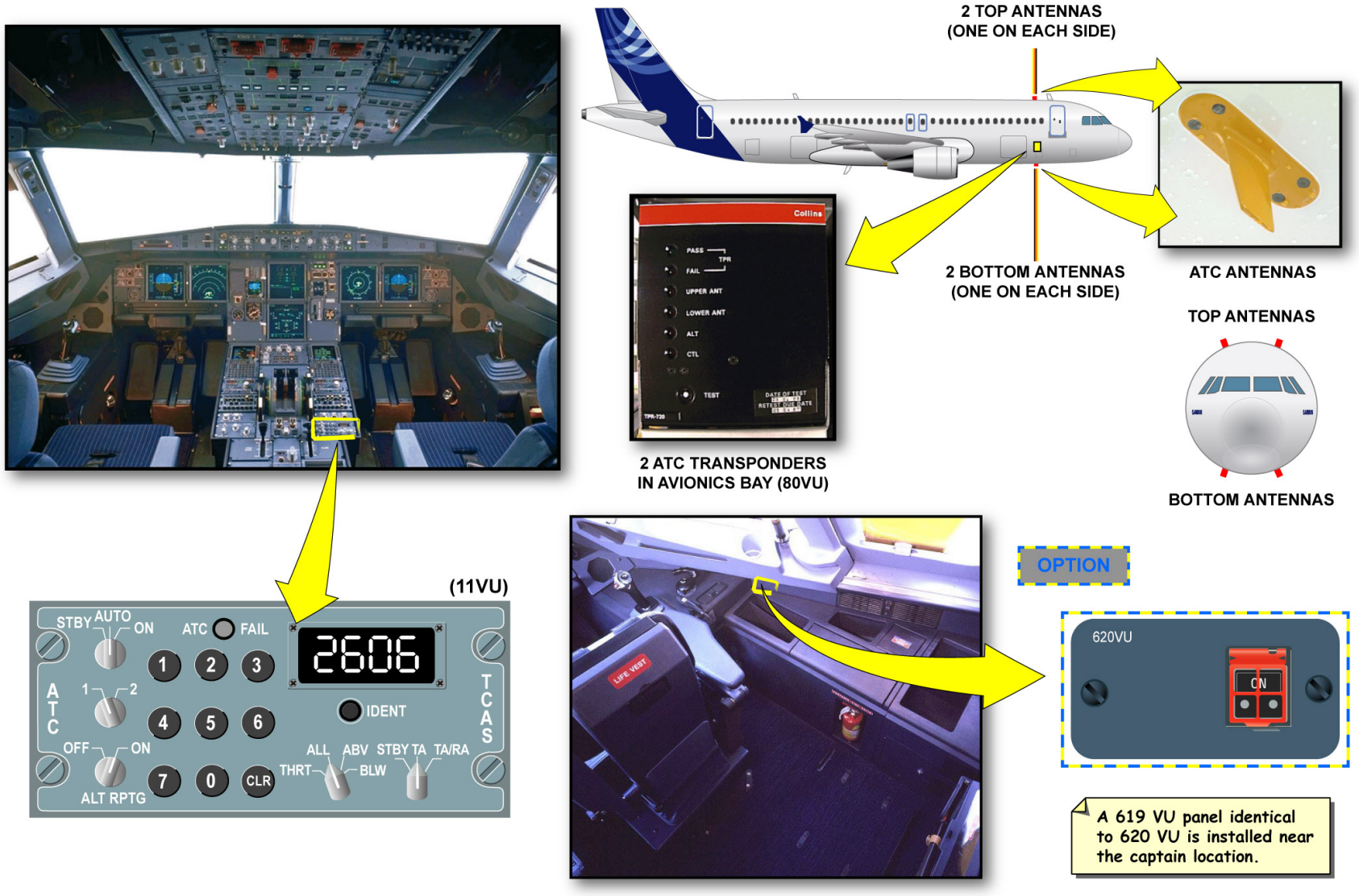
COMPONENT LOCATION

The components are:
- two transponders in the avionics bay (80VU),
- two top and two bottom antennas and,
- one ATC/TCAS control panel.

In case of hijack, two P/BSWs are optionally installed near the captain and first officer locations in order to activate emergency functions. Aural and lighted warnings are also activated in cabin to notify the cabin crew that the cockpit crew will be threatened.

NOTE: The ATC/TCAS control panel shown here after is given as example. It may differ according to the aircraft configuration.

UGB13131 - U7ST0M0 - UM34PB000000001



COMPONENT LOCATION

ATC DESCRIPTION/OPERATION (3)

GENERAL

The Air Traffic Control (ATC) system includes:
- 1 ATC/Traffic Alert and Collision Avoidance System (TCAS) control panel (common to both systems),
- 2 transponders,
- 4 antennae.

NOTE: Two alerting P/BSWs can optionally be installed in the cockpit in case of hijack. When the hijack code is transmitted, the two P/BSWs come ON. Aural and lighted warnings are also activated in cabin to notify the cabin crew that the cockpit crew will be threatened.

CONTROL PANEL

A single ATC/TCAS control panel enables system selection. It provides the selected transponder with code and function data and, in return, receives status data. The ATC/TCAS control panel converts selected mode and selected code data into digital data and transmits this data in ARINC 429 format to the selected transponder. In order to monitor the ATC transponders and generate alerts by the Flight Warning System (FWS), the ATC/TCAS control panel is connected to the System Data Acquisition Concentrators (SDACs) by two discretes connections. The Landing Gear Control and Interface Units (LGCIUs) provide a ground/flight discrete signal to the ATC transponder via the ATC/TCAS control panel for BITE purposes.

TRANSPONDER

In normal operation, one ATC transponder operates and the other is in standby mode. The operating mode (A, C or S) of the transponder is determined by the decoding of the time between the interrogation pulses. The main function of the mode S transponder is surveillance. Each transponder has its own and unique address coded on 24 bits so that every interrogation can be directed to a specific aircraft preventing multiple replies. The mode S is also used in collision avoidance (TCAS).

NOTE: The links between the ATC and the Air Traffic Service Unit (ATSU), the Flight Control Unit (FCU) and the Inertial Reference (IR) part of the Air Data/Inertial Reference Unit (ADIRU) are optionally installed for enhanced surveillance/extended squitters. The links between the MMRs are for extended squitters only.

ANTENNAE

The ATC antennae transmit replies to interrogations from the ATC ground station. Top and bottom antennas provide the antenna diversity features that allow a better radar coverage. The antenna operates in the 960 MHz to 1.220 MHz frequency band with an interrogation frequency of 1.030 MHz and a reply frequency of 1.090 MHz.

SUPPRESSOR

The ATC, the DME and the TCAS operate in the same frequency range. A suppressor signal is transmitted, via a coaxial, by the operating system to inhibit the other systems and to prevent simultaneous transmission.

ADIRU

ADIRU 1 and ADIRU 2 provide barometric altitude to associated transponders for mode C. In case of failure of ADIRU 1 or 2, the pilot can switch to ADIRU 3 through the AIR DATA selector switch.

FMGC

The Flight Management and Guidance Computers (FMGCs) provide the flight number. This data will be transmitted to an ATC ground station after a mode S interrogation.

CFDIU

The Centralized Fault Display Interface Unit (CFDIU) allows testing and trouble-shooting of the ATC system through the MCDUs. The tests are only available on ground.

TCAS

The TCAS allows individual communications with each TCAS equipped aircraft through the Mode S transponder. This enables a coordination of avoidance maneuvers by acquisition, at regular intervals, of the relative altitude and the separation range.

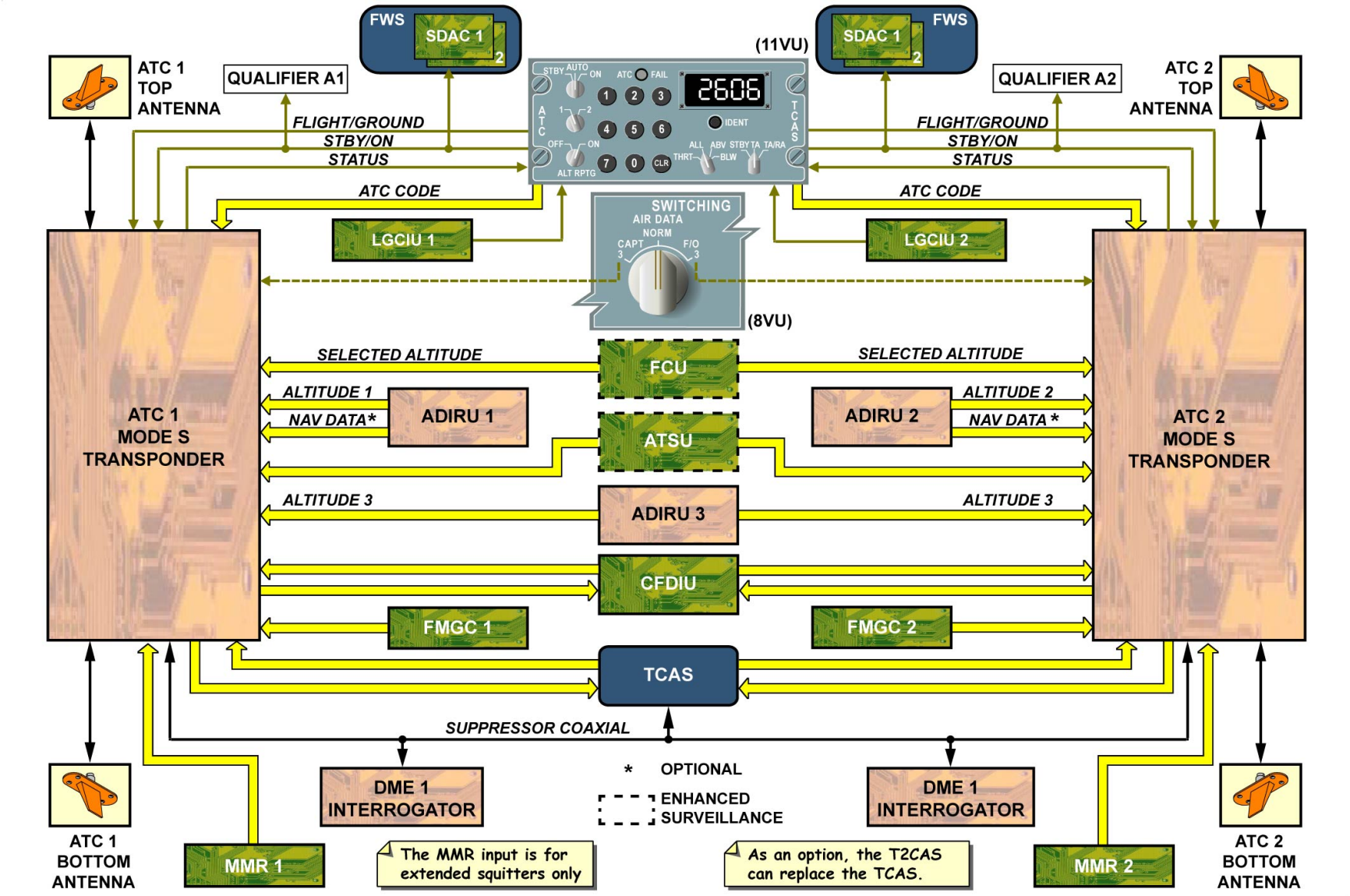
NOTE: As an option, the Traffic and Terrain Collision Avoidance System (T2CAS) can replace the TCAS.

CONDITIONS TO TRANSMIT ADS-B PARAMETERS ON AIRBUS A320 FAMILY

The Automatic Dependant Surveillance-Broadcast (ADS-B) application is hosted by the transponder. On Airbus A320 family, there are conditions to transmit ADS-B parameters:
- an Enhanced Surveillance (EHS) wiring provision (basic),
- transponders capable of Elementary Surveillance (ELS)/EHS/ADS-B (compliant DO-260),
- a Multi-Mode Receiver (MMR) from any vendor or Global Positioning System Sensor Unit (GPSSU) from Honeywell.

NOTE: No need of pin programming to activate ADS-B data transmission. Need certification for operational use if required by regulation.

For the retrofit aircraft of the A320 family, an Airbus Service Bulletin for ADS-B OUT certification is available: SB 34-1418. But, for the forward fit aircraft of the A320 family, the ADS-B OUT certification is proposed as an option on production aircraft: CN.34.52.117 / 02.



GENERAL ... CONDITIONS TO TRANSMIT ADS-B PARAMETERS ON AIRBUS A320 FAMILY

This Page Intentionally Left Blank

UGB13131 - U7ST0M0 - UM34DH000000001

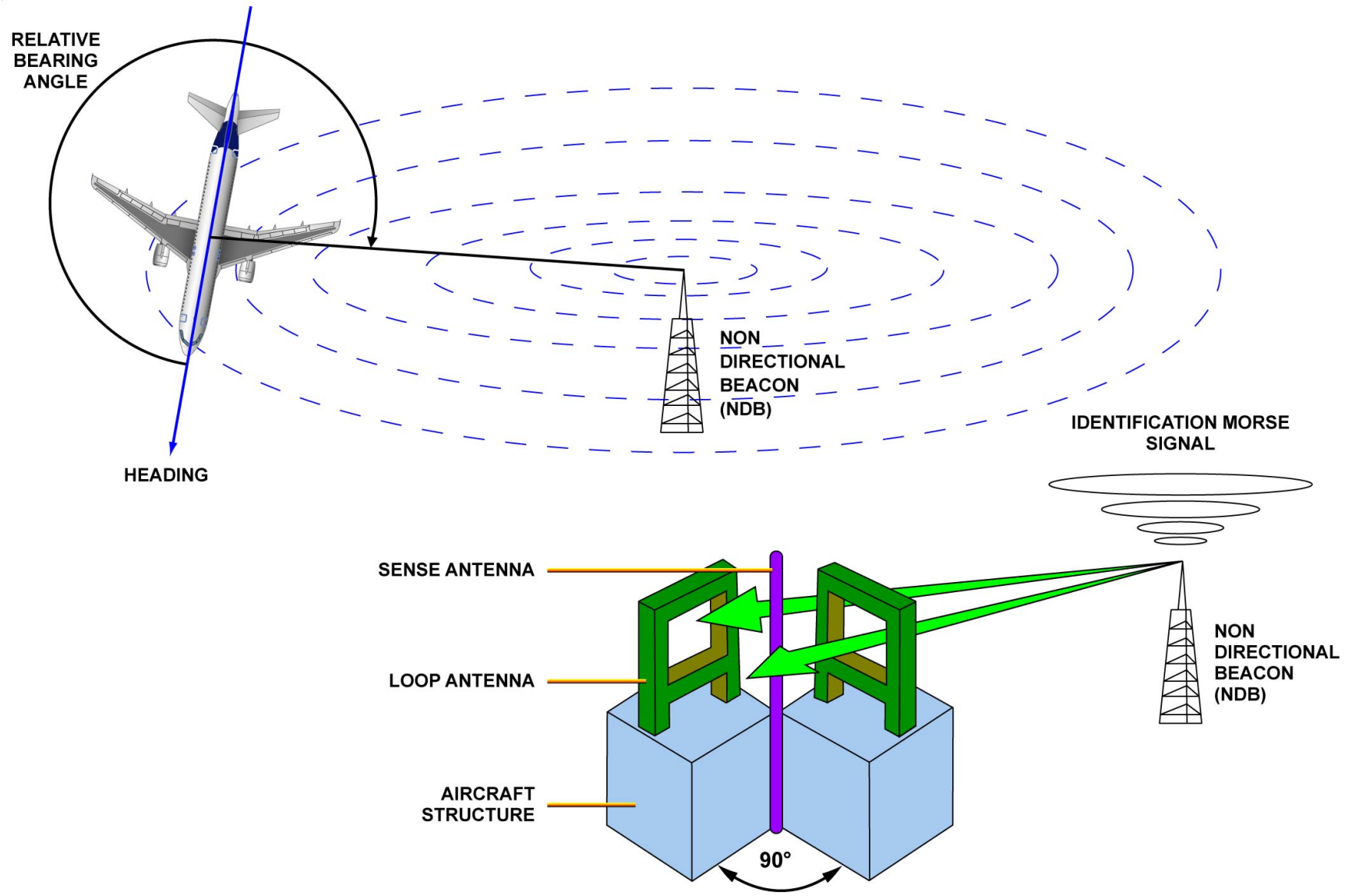
ADF SYSTEM PRESENTATION (2)

PRINCIPLE

The ADF is a radio navigation aid. It provides:
- the relative bearing of the aircraft to a selected ground station called Non-Directional Beacon (NDB),
- an aural identification of the ground station.

The relative bearing is the angle between the aircraft heading and the aircraft/ground station axis. The combination of signals, received from two loop antennas and from one omni-directional sense antenna, provides bearing information. The ground stations operate in a frequency range of 190 kHz to 1.750 kHz. An additional Morse signal is provided to identify the selected ground station.

UGB13131 - U7ST0M0 - UM34PC000000001


RELATIVE
BEARING
ANGLE
HEADING
NON
DIRECTIONAL
BEACON
(NDB)
IDENTIFICATION MORSE
SIGNAL
SENSE ANTENNA
LOOP ANTENNA
AIRCRAFT
STRUCTURE
90°
NON
DIRECTIONAL
BEACON
(NDB)

PRINCIPLE

ADF SYSTEM PRESENTATION (2)

COMPONENT LOCATION

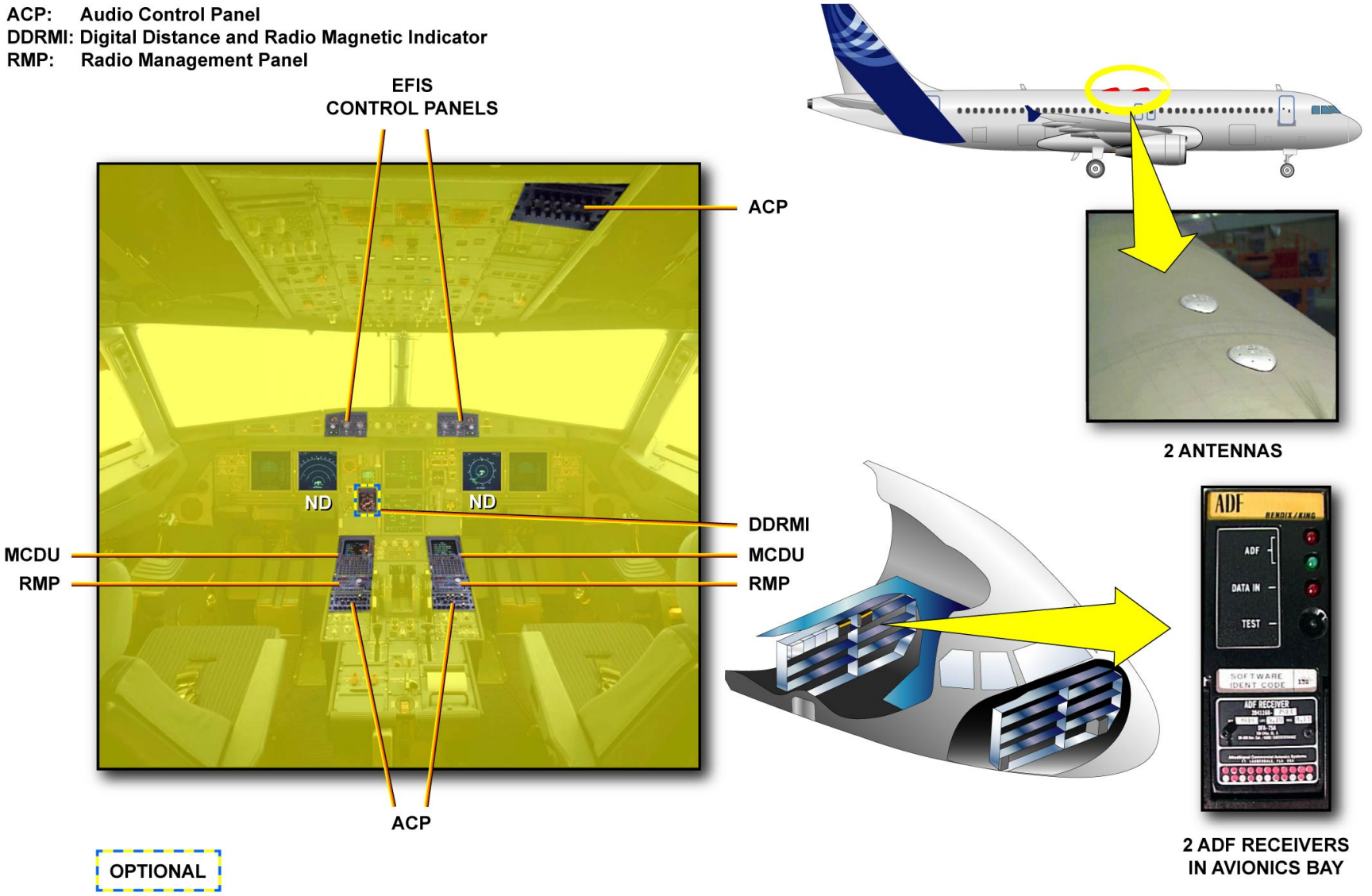
The ADF system has two receivers and two antennas. The ADF system is also connected to:
- NDs and optional Digital Distance and Radio Magnetic Indicator (DDRMI) for display,
- EFIS control panels for control display,
- Flight Management and Guidance Computers (FMGCs) for auto-tuning,
- MCDUs for manual tuning,
- CAPT and F/O Radio Management Panels (RMPs) for back-up tuning and,
- Audio Control Panels (ACPs) for ADF audio signal.

The ADF radio-navigation receiver antennas are installed on the upper fuselage.
Two ADF receivers are installed in the avionics bay.

NOTE: The ADF 2 system is optional.

UGB13131 - U7ST0M0 - UM34PC000000001

ACP: Audio Control Panel
DDRMI: Digital Distance and Radio Magnetic Indicator
RMP: Radio Management Panel



COMPONENT LOCATION

ADF SYSTEM PRESENTATION (2)

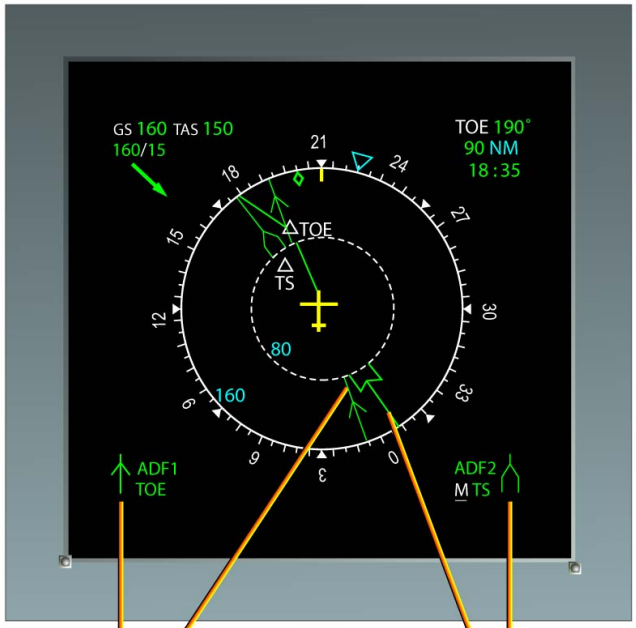
INDICATING

The ADF system information can be displayed on the NDs and on the optional DDRMI. On the NDs, depending on the position of the VOR/ADF selector switch on the EFIS control panel:
- ADF 1 is represented by a single pointer,
- ADF 2 is represented by a double pointer.

On the optional DDRMI, depending on the position of the VOR/ADFselector switch:
- ADF 1 is represented by a single pointer,
- ADF 2 is represented by a double pointer.

NOTE: Some DDRMIs are not equipped with the ADF capability.

UGB13131 - U7ST0M0 - UM34PC000000001



ND

ADF 1
(SINGLE POINTER)

ADF 2
(DOUBLE POINTER)

EFIS CONTROL PANEL (13VU)

DDRMI (401VU)

ADF 1
(SINGLE POINTER)

ADF 2
(DOUBLE POINTER)

VOR/ADF SELECTOR
SWITCHES

OPTIONAL

INDICATING

ADF DESCRIPTION/OPERATION (3)

GENERAL

The ADF system includes:
- 2 identical ADF receivers,
- 2 identical ADF antennas.

NOTE: ADF 2 system is optional.

AUTO TUNING

In Non-Directional Beacon (NDB) approach each Flight Management and Guidance Computer (FMGC) automatically tunes its ownside ADF receiver through its ownside Radio Management Panel (RMP). With failure of one FMGC, the other FMGC can control the two ADF receivers, one directly, the other through its RMP. When the FMGC fails, the ADF receives a discrete signal through the RMP to automatically select port B.

MANUAL TUNING

From each MCDU both ADFs can be manually tuned through their ownside FMGC.

BACK-UP TUNING

In case of dual FMGC failure, the RMPs enable back-up tuning.

ANTENNAS

The ADF antenna provides three signals and consists of one sense antenna and two loop antennas called longitudinal antenna and lateral antenna.
The ADF antenna comprises:
- one pre-amplifier, for each antenna, supplied by the ADF receiver in +/- 12V DC,
- a test loop, which enables a self-test.

The ADF ground stations operate in a frequency range of 190 kHz to 1.750 kHz divided into two parts:
- NDB: 190 kHz to 550 kHz,
- standard commercial broadcast AM stations: 550 kHz to 1.610 kHz.

LGCIU

Each Landing Gear Control and Interface Unit (LGCIU) sends discrete signals to the associated ADF receiver. This ground/flight information is used by the receiver BITE module to count the flight legs.

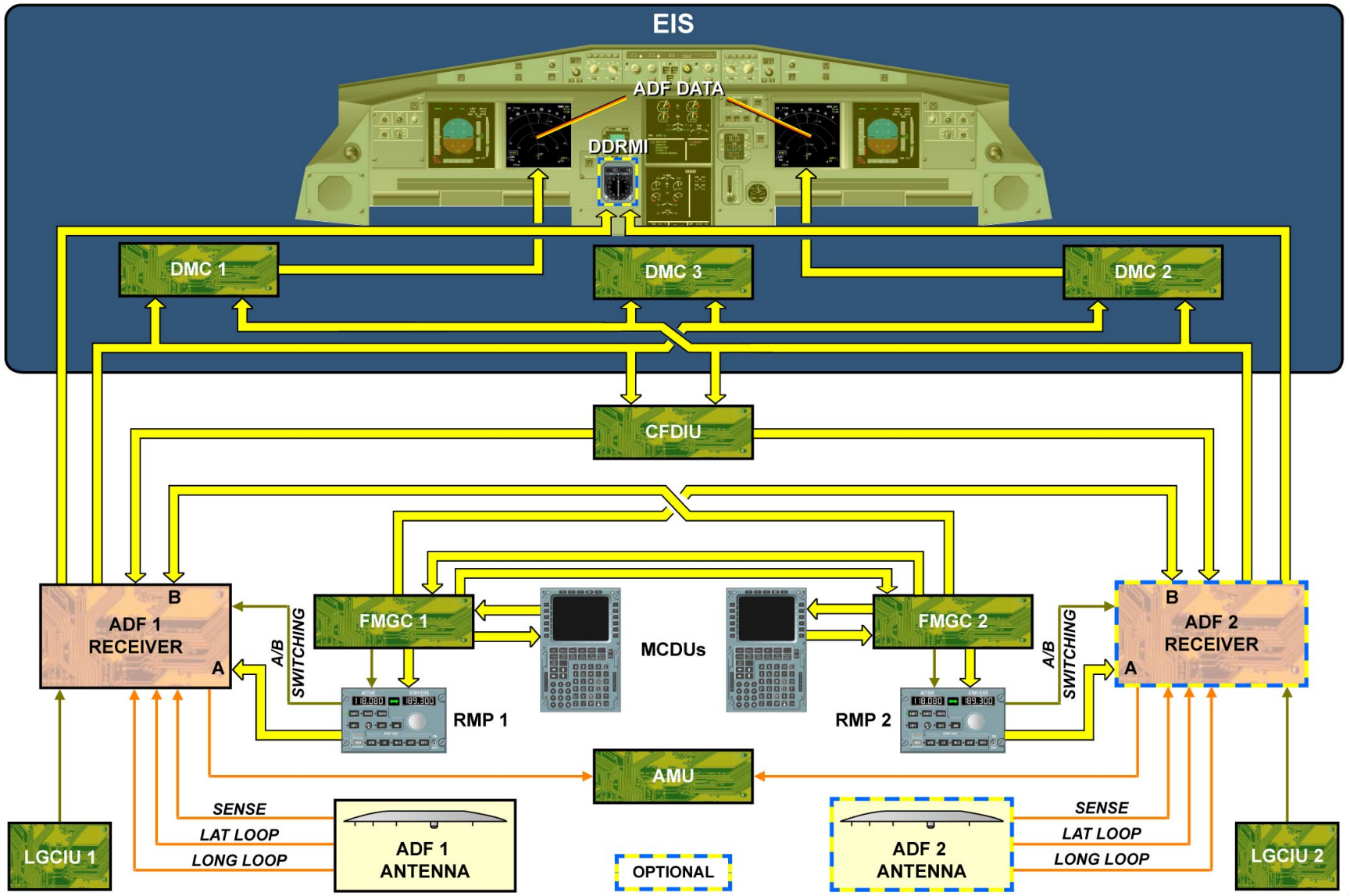
INDICATING

The ADF data is sent to the NDs through the Display Management Computers (DMCs) and directly to the optional Digital Distance and Radio Magnetic Indicator (DDRMI). The ADF audio signal is processed by the receiver and sent to the Audio Management Unit (AMU) and can be heard by the crew.

NOTE: Some DDRMIs are not equipped with the ADF capability.

CFDIU

The MCDUs allow the systems to be tested and trouble shooting to be performed via the Centralized Fault Display Interface Unit (CFDIU). The tests are only available on ground.



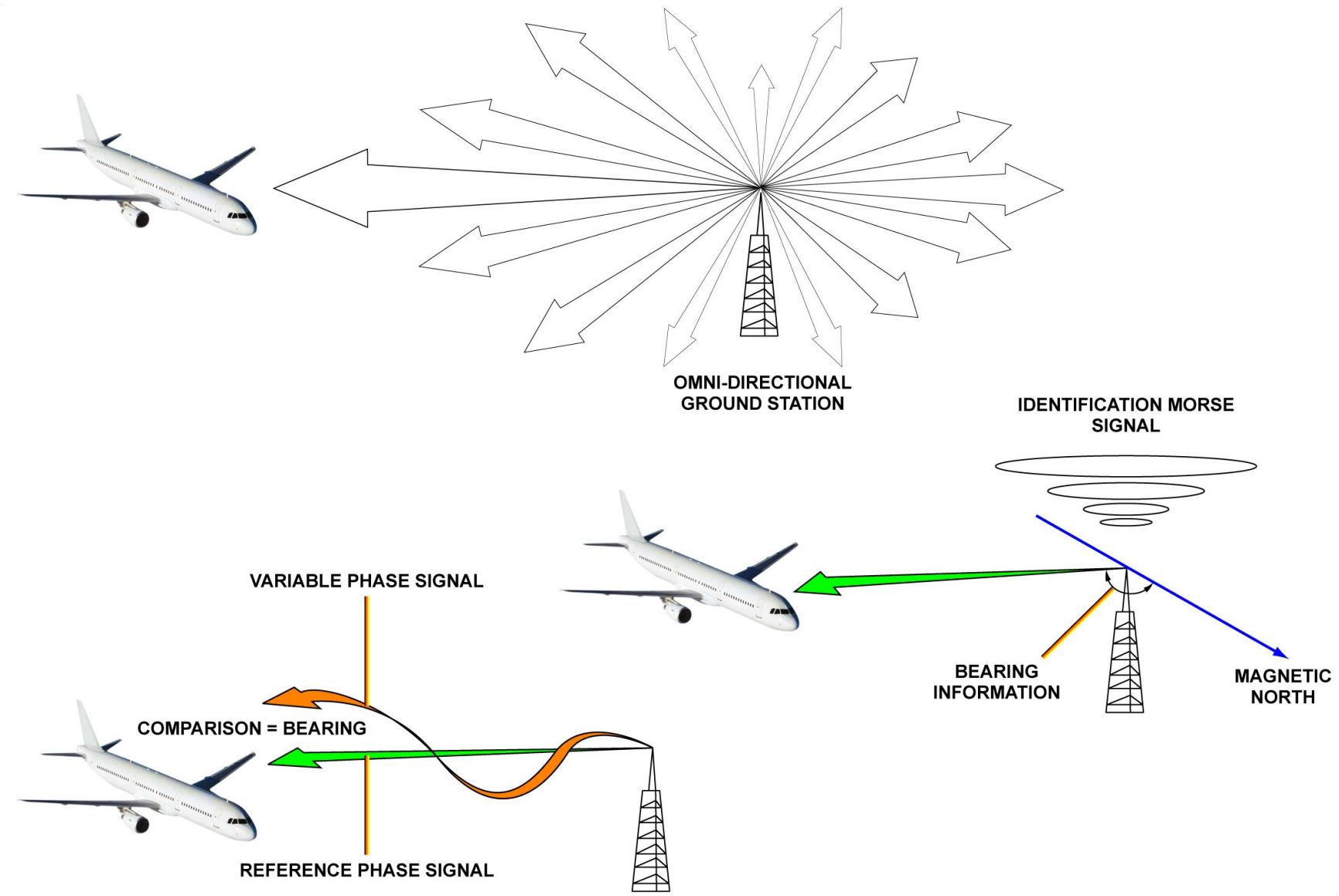
GENERAL ... CFDIU

VOR/MKR SYSTEM PRESENTATION (2)

VOR PRINCIPLE

The VOR system is a medium-range radio navigation aid. The VOR system receives, decodes and processes bearing information from the omni-directional ground station, working in the frequency range of 108 MHz to 117.95 MHz. The ground VOR station generates a reference phase signal and a variable phase signal. The phase difference between these signals, called bearing, is function of the aircraft position with respect to the ground station. The bearing is the angle between the magnetic north and the ground station/aircraft axis. Furthermore, the VOR station provides a Morse identification, which identifies the station.

UGB13131 - U7ST0M0 - UM34PD000000001



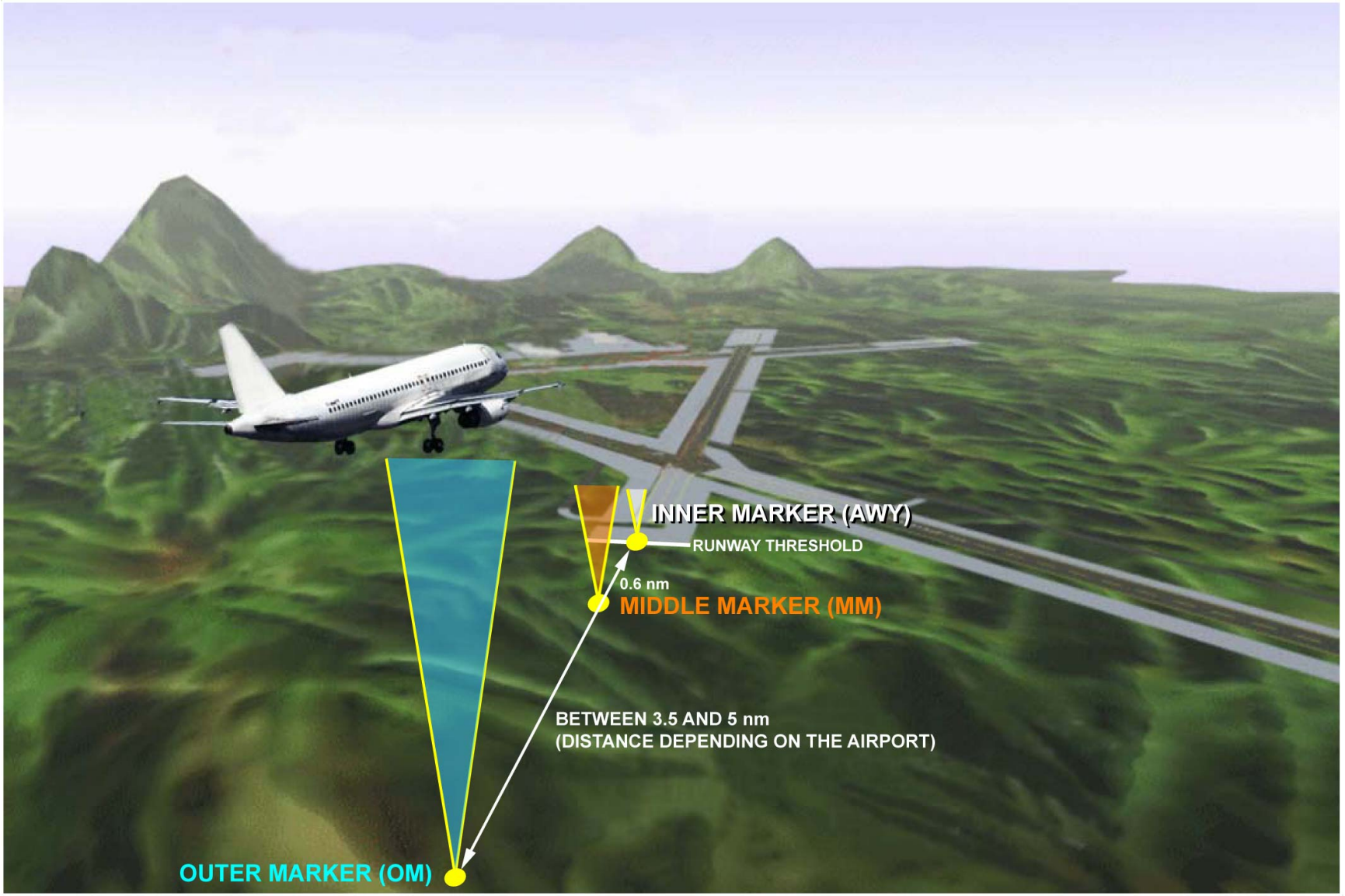
VOR PRINCIPLE

VOR/MKR SYSTEM PRESENTATION (2)

MKR PRINCIPLE

The MKR system is a radio navigation aid, which indicates the distance between the aircraft and the runway threshold. The MKR system is normally used together with the ILS system during an ILS approach.

UGB13131 - U7ST0M0 - UM34PD000000001



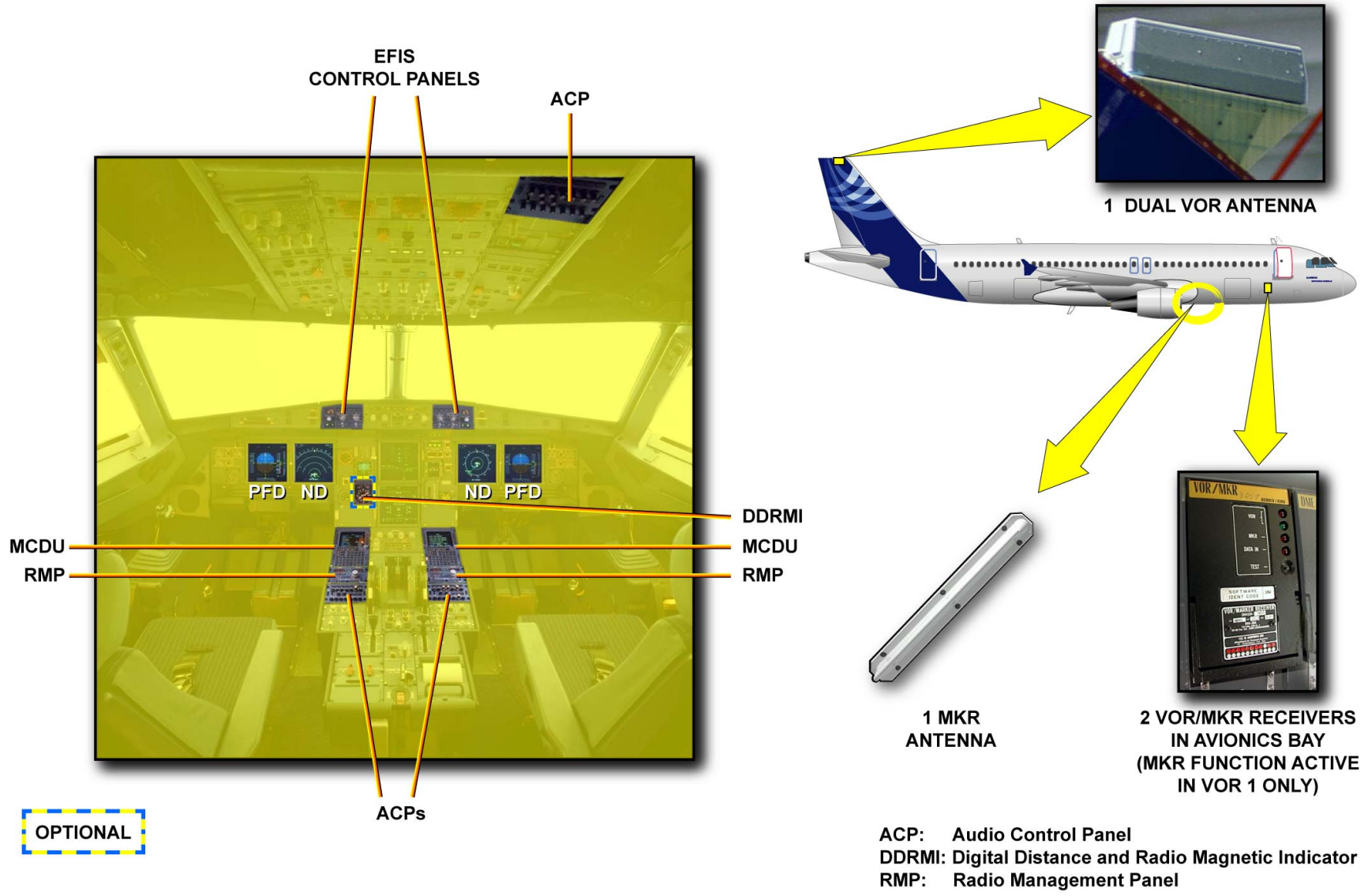
MKR PRINCIPLE

VOR/MKR SYSTEM PRESENTATION (2)

COMPONENTS

The VOR and MKR systems are composed of two receivers, one MKR antenna and one dual VOR antenna. The VOR/MKR system is also connected to:
- NDs, PFDs and optional Digital Distance and Radio Magnetic Indicator (DDRMI) for display,
- EFIS control panels for control display,
- Flight Management and Guidance Computers (FMGCs) for auto-tuning,
- MCDU for manual tuning,
- CAPT and F/O Radio Management Panels (RMPs) for back-up tuning,
- Audio Control Panels (ACPs) for VOR/MKR audio signal.

UGB13131 - U7ST0M0 - UM34PD000000001


EFIS
CONTROL PANELS
ACP
PFD
ND
ND
PFD
DDRMI
MCDU
RMP
MCDU
RMP
ACPs
OPTIONAL
1 DUAL VOR ANTENNA
1 MKR
ANTENNA
2 VOR/MKR RECEIVERS
IN AVIONICS BAY
(MKR FUNCTION ACTIVE
IN VOR 1 ONLY)
ACP: Audio Control Panel
DDRMI: Digital Distance and Radio Magnetic Indicator
RMP: Radio Management Panel

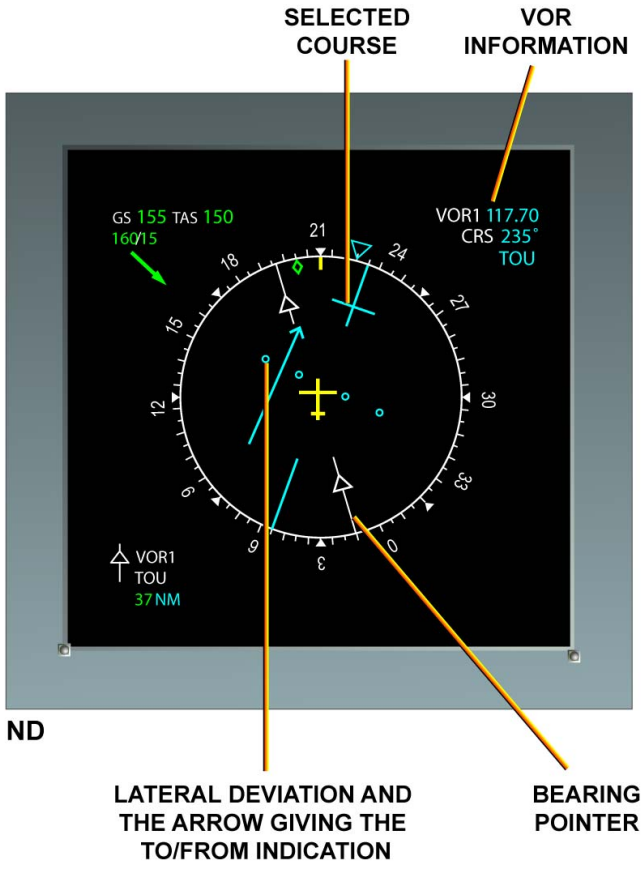
COMPONENTS

VOR/MKR SYSTEM PRESENTATION (2)

VOR INDICATING

TO A SELECTED COURSE

The indicators show that the aircraft is flying to the ground station and is on the right hand side of the course selected by the pilot.

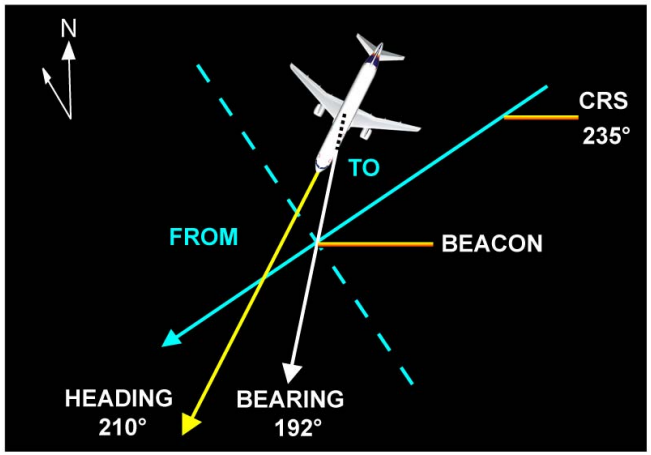


EFIS CONTROL PANEL (13VU)

DDRMI

BEARING POINTER (VOR1)

OPTIONAL



CRS: Course

FLIGHT REPRESENTATION

VOR INDICATING - TO A SELECTED COURSE

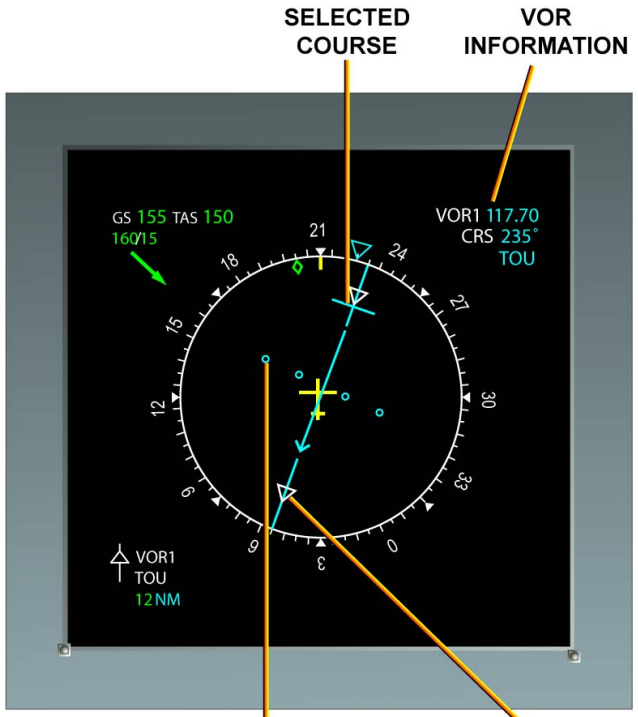
VOR/MKR SYSTEM PRESENTATION (2)

VOR INDICATING (continued)

CROSSING A SELECTED COURSE

The indicators show that the aircraft is flying from the ground station and is crossing the course selected by the pilot.

UGB13131 - U7ST0M0 - UM34PD000000001

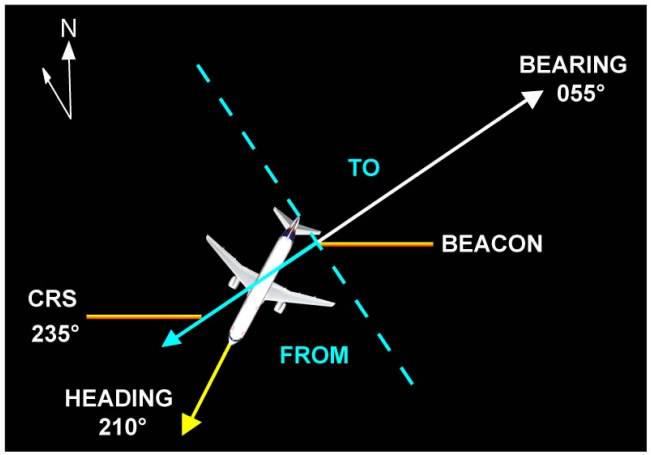


EFIS CONTROL PANEL (13VU)

DDRMI

BEARING POINTER (VOR1)

OPTIONAL



FLIGHT REPRESENTATION

VOR INDICATING - CROSSING A SELECTED COURSE

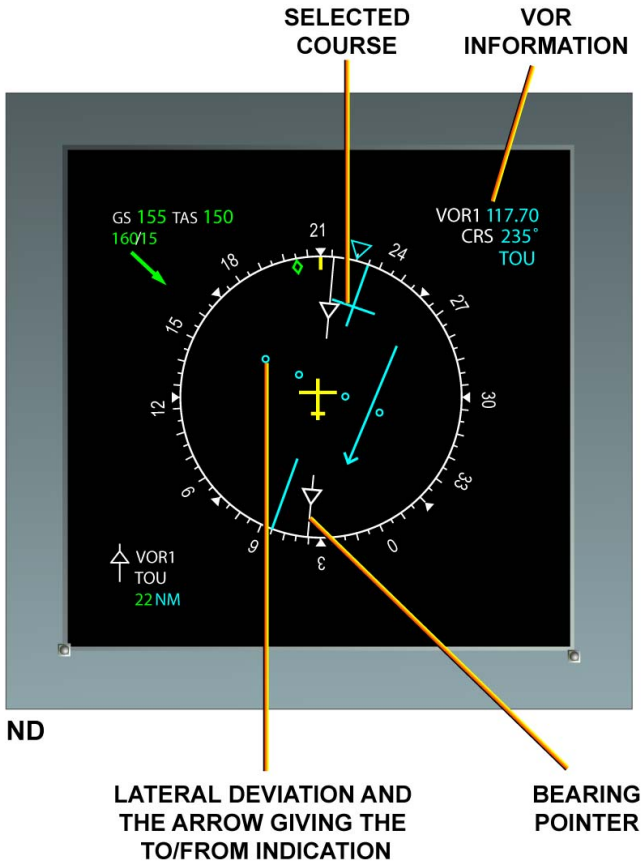
VOR/MKR SYSTEM PRESENTATION (2)

VOR INDICATING (continued)

FROM A SELECTED COURSE

The indicators show that the aircraft is flying from the ground station and is on the left hand side of the course selected by the pilot.

UGB13131 - U7ST0M0 - UM34PD000000001

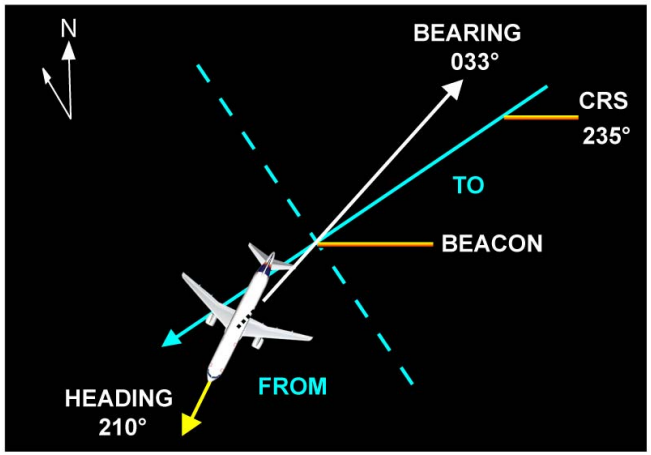


EFIS CONTROL PANEL (13VU)

DDRMI

BEARING POINTER (VOR1)

OPTIONAL



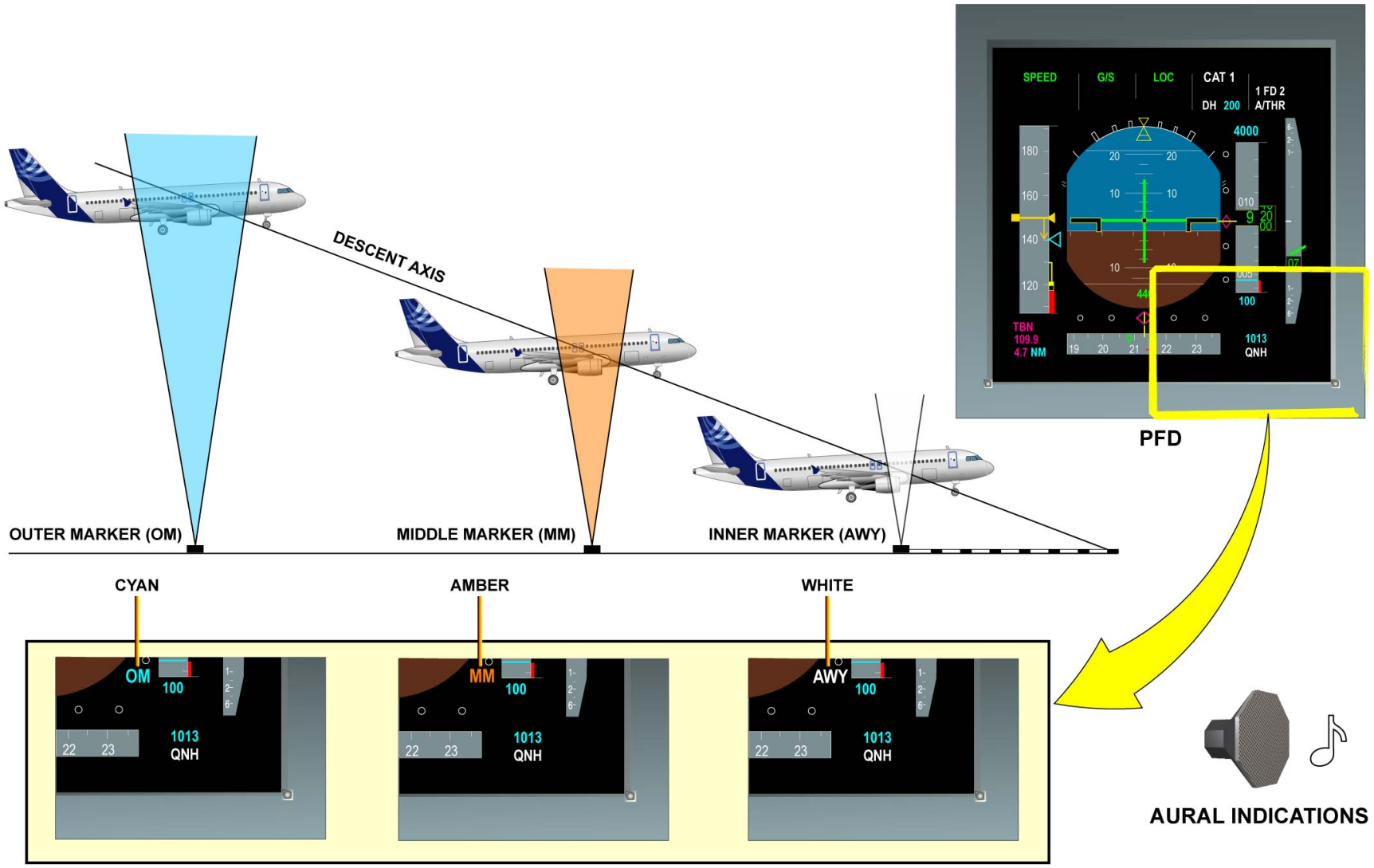
FLIGHT REPRESENTATION

VOR INDICATING - FROM A SELECTED COURSE

VOR/MKR SYSTEM PRESENTATION (2)

MKR INDICATING

When the aircraft overflies the MKR, the type of MKR is display on the PFDs in different colors, and is indicated by an aural identification.



OVERFLY MARKER INDICATIONS WITH CORRESPONDING COLORS

MKR INDICATING

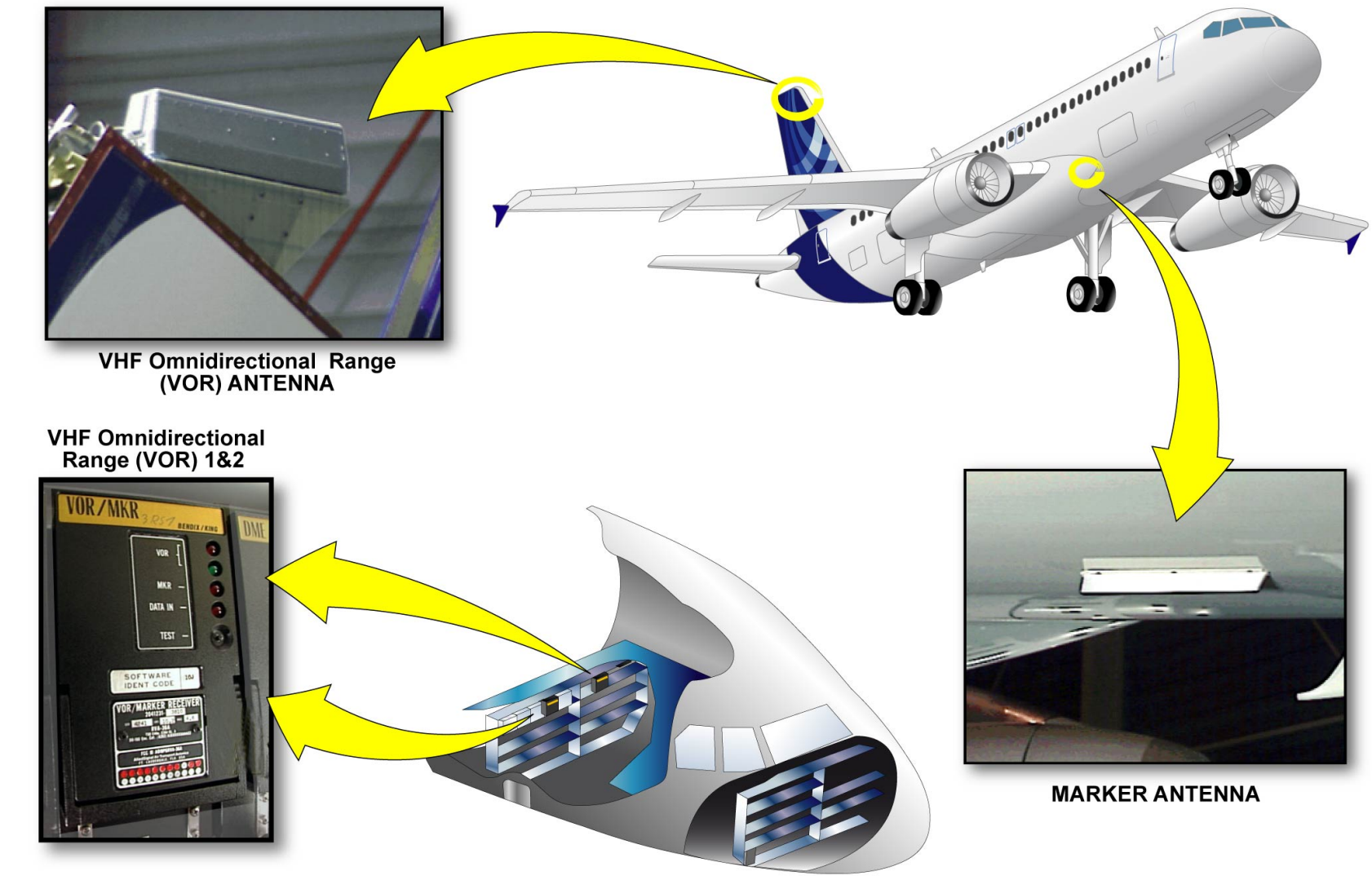
UGB13131 - U7ST0M0 - UM34PD000000001

VOR/MKR SYSTEM PRESENTATION (2)

COMPONENT LOCATION

The marker antenna is installed on the lower fuselage and the dual VOR antenna at the top of the vertical stabilizer.
There are two receivers (VOR1 & VOR2) in the avionics bay (80VU).

UGB13131 - U7ST0M0 - UM34PD000000001



COMPONENT LOCATION

VOR/MKR DESCRIPTION/OPERATION (3)

GENERAL

The VOR and MKR system includes:
- 2 identical VOR/MKR receivers (only 1 MKR system is installed on aircraft),
- 1 dual VOR antenna,
- 1 MKR antenna.

VOR AUTO TUNING

In normal operation each Flight Management and Guidance Computer (FMGC) automatically tunes its ownside VOR receiver through its ownside Radio Management Panel (RMP) via port A. With failure of one FMGC, the other FMGC can control the two VOR/MKR receivers, one directly, the other through its RMP. When the FMGC fails, the VOR receives a discrete signal through the RMP to automatically select port B.

VOR MANUAL TUNING

From each MCDU both VORs can be manually tuned through their ownside FMGC.

VOR BACK-UP TUNING

In case of dual FMGC failure, the RMPs enable back-up tuning.

VOR ANTENNA

The dual VOR antenna receives the signals coming from the ground stations. The VOR antenna operates in the 108 MHz to 117.95 MHz range.

VOR USERS

The VOR data is sent to the FMGCs for aircraft position computation.

MKR CONTROL

The system consists of two identical VOR/MKR receivers but only MKR one is operative as it is connected to the MKR antenna. The MKR system operates at a fixed frequency and does not need any control.

MKR ANTENNA

The MKR antenna receives MKR signals when the aircraft flies over the MKR beacons. The MKR antenna operates at 75 MHz.

AMU

The pilot can adjust the volume of the VOR ground station and MKR beacon identification signals using the VOR and MKR P/Bs on the Audio Control Panel (ACP). Selected VOR ground station and MKR beacon identification audio signals are transmitted to Audio Management Unit (AMU) and then dispatched to the headsets and/or loudspeakers.

LGCIU

Each Landing Gear Control and Interface Unit (LGCIU) sends discrete signals to the associated VOR receiver. This ground/flight information is used by the receiver BITE module to count the flight legs.

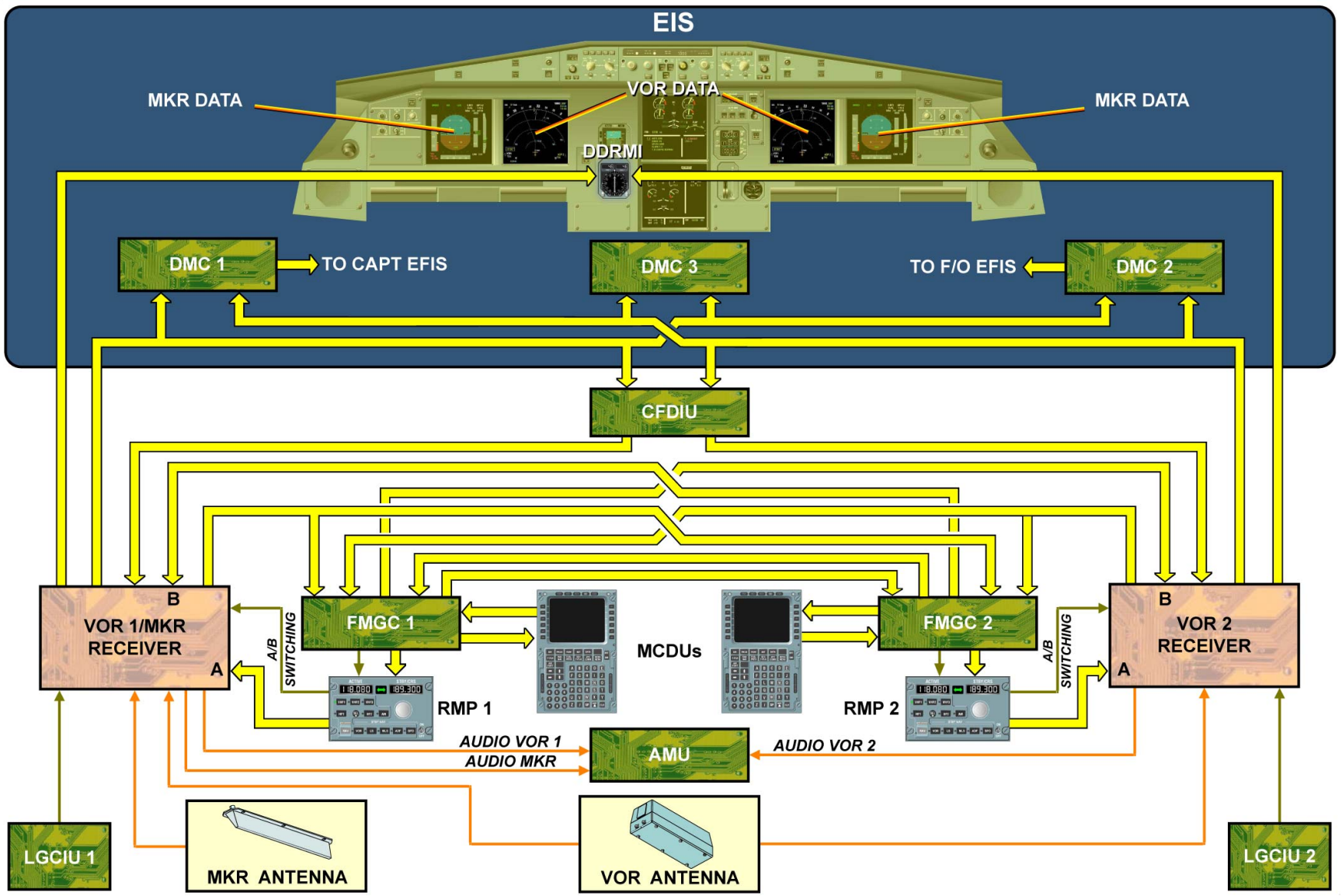
INDICATING

VOR data is sent to the NDs through the Display Management Computers (DMCs) and directly to the Digital Distance and Radio Magnetic Indicator (DDRMI). The MKR data is sent to the PFDs through the DMCs.

CFDIU

The MCDUs allow the systems to be tested and trouble shooting to be performed via the Centralized Fault Display Interface Unit (CFDIU). The tests are only available on ground.

UGB13131 - U7ST0M0 - UM34DJ000000001



GENERAL ... CFDIU

NAVIGATION SYSTEM OPERATION, CONTROL & INDICATING (3)

RA FAILURE

ADIRU FAILURE

UGB13131 - U7ST0M0 - UM34IZLEVEL0302

This Page Intentionally Left Blank

AIRBUS S.A.S.
31707 BLAGNAC cedex, FRANCE
STM
REFERENCE UGB13131
APRIL 2013
PRINTED IN FRANCE
AIRBUS S.A.S. 2013
ALL RIGHTS RESERVED

AN EADS COMPANY